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06/28/01

<110> Chappell, Joseph
Noel, Joseph P.
Starks, Courtney M.
Manna, Kathleen R.

<120> SYNTHASES

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 Val Ala Asp Phe Ser Pro Ser Leu Trp Gly Asp Gln Phe Leu Ser Phe
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 Ser Ile Asp Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu Ile Glu Ala
 35 40 45
 ttg aag gaa caa acg agg agt atg ctg tta gca acc gga agg aaa ttg 192
 Leu Lys Glu Gln Thr Arg Ser Met Leu Leu Ala Thr Gly Arg Lys Leu
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 gcc gat aca ttg aat ttg att gac att att gaa cgc ctt ggt ata tcc 240
 Ala Asp Thr Leu Asn Leu Ile Asp Ile Ile Glu Arg Leu Gly Ile Ser
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 Tyr His Phe Glu Lys Glu Ile Asp Glu Ile Leu Asp Gln Ile Tyr Asn
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 Gln Asn Ser Asn Cys Asn Asp Leu Cys Thr Ser Ala Leu Gln Phe Arg
 100 105 110
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 Leu Leu Arg Gln His Gly Phe Asn Ile Ser Pro Glu Ile Phe Ser Lys
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 Phe Gln Asp Glu Asn Gly Lys Phe Lys Glu Ser Leu Ala Ser Asp Val
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Phe	Phe	Ile	Ser	Ser	Ile	Tyr	Asp	Lys	Glu	Gln	Ser	Lys	Asn	Asn	Val			
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Ala	Asp	Thr	Leu	Asn	Leu	Ile	Asp	Ile	Ile	Glu	Arg	Leu	Gly	Ile	Ser	
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Gln	Asn	Ser	Asn	Cys	Asn	Asp	Leu	Cys	Thr	Ser	Ala	Leu	Gln	Phe	Arg	
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Leu	Leu	Arg	Gln	His	Gly	Phe	Asn	Ile	Ser	Pro	Glu	Ile	Phe	Ser	Lys	
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Phe	Gln	Asp	Glu	Asn	Gly	Lys	Phe	Lys	Glu	Ser	Leu	Ala	Ser	Asp	Val	
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Gln	Asn	Met	Ala	Glu	Thr	Ala	Trp	Lys	Asp	Ile	Asn	Glu	Gly	Leu	Leu
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Tyr	Glu	Val	Glu	Lys	Ser	Arg	Gly	Gln	Ile	Ala	Thr	Gly	Ile	Glu	Cys
	450					455					460				
Cys	Met	Arg	Asp	Tyr	Gly	Ile	Ser	Thr	Lys	Glu	Ala	Met	Ala	Lys	Phe
465					470					475					480
Gln	Asn	Met	Ala	Glu	Thr	Ala	Trp	Lys	Asp	Ile	Asn	Glu	Gly	Leu	Leu
				485					490					495	
Arg	Pro	Thr	Pro	Val	Ser	Thr	Glu	Phe	Leu	Thr	Pro	Ile	Leu	Asn	Leu
			500					505					510		
Ala	Arg	Ile	Val	Glu	Val	Thr	Tyr	Ile	His	Asn	Leu	Asp	Gly	Tyr	Thr
		515					520					525			
His	Pro	Glu	Lys	Val	Leu	Lys	Pro	His	Ile	Ile	Asn	Leu	Leu	Val	Asp
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Ser	Ile	Lys	Ile												
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1 5 10 15	
gtc gcc gac ttc tcc cct agt ctc tgg ggt gat cag ttc ctt tca ttc	96
Val Ala Asp Phe Ser Pro Ser Leu Trp Gly Asp Gln Phe Leu Ser Phe	
20 25 30	
tcc att gat aat cag gtt gcg gaa aag tat gct caa gag att gaa gca	144
Ser ile Asp Asn Gln Val Ala Glu Lys Tyr Ala Gln Glu ile Glu Ala	
35 40 45	
ttg aag gaa caa acg agg agt atg ctg tta gca acc gga agg aaa ttg	192
Leu Lys Glu Gln Thr Arg Ser Met Leu Leu Ala Thr Gly Arg Lys Leu	
50 55 60	
gcc gat aca ttg aat ttg att gac att att gaa cgc ctt ggt ata tcc	240
Ala Asp Thr Leu Asn Leu ile Asp ile ile Glu Arg Leu Gly ile Ser	
65 70 75 80	
tac cac ttt gag aaa gaa att gat gag att ttg gat cag att tac aac	288
Tyr His Phe Glu Lys Glu ile Asp Glu ile Leu Asp Gln ile Tyr Asn	
85 90 95	
caa aac tca aac tgc aat gat ttg tgc acc tct gca ctt caa ttt cga	336
Gln Asn Ser Asn Cys Asn Asp Leu Cys Thr Ser Ala Leu Gln Phe Arg	
100 105 110	
ttg ctc agg caa cac ggt ttc aac atc tct cct gaa att ttc agc aaa	384
Leu Leu Arg Gln His Gly Phe Asn ile Ser Pro Glu ile Phe Ser Lys	
115 120 125	
ttc caa gat gaa aat ggc aaa ttc aag gag tct ctt gct agt gat gtc	432
Phe Gln Asp Glu Asn Gly Lys Phe Lys Glu Ser Leu Ala Ser Asp Val	
130 135 140	
tta gga tta tta aac ttg tat gaa gct tca cat gta agg act cat gct	480
Leu Gly Leu Leu Asn Leu Tyr Glu Ala Ser His Val Arg Thr His Ala	
145 150 155 160	
gac gat atc tta gaa gac gca ctt gct ttc tcc act atc cat ctt gaa	528
Asp Asp ile Leu Glu Asp Ala Leu Ala Phe Ser Thr ile His Leu Glu	
165 170 175	

tct	gca	gct	cca	cat	ttg	aaa	tct	cca	ctt	agg	gag	caa	gtg	aca	cat	576
Ser	Ala	Ala	Pro	His	Leu	Lys	Ser	Pro	Leu	Arg	Glu	Gln	Val	Thr	His	
			180					185					190			
gcc	ctt	gag	caa	tgt	ttg	cac	aag	ggt	gtt	cct	aga	gtc	gag	acc	cga	624
Ala	Leu	Glu	Gln	Cys	Leu	His	Lys	Gly	Val	Pro	Arg	Val	Glu	Thr	Arg	
		195					200					205				
ttc	ttc	atc	tca	tca	atc	tat	gac	aag	gaa	caa	tcg	aag	aat	aac	gtg	672
Phe	Phe	Ile	Ser	Ser	Ile	Tyr	Asp	Lys	Glu	Gln	Ser	Lys	Asn	Asn	Val	
	210					215					220					
tta	ctt	cga	ttt	gcc	aaa	ttg	gat	ttc	aac	ttg	ctc	cag	atg	ttg	cac	720
Leu	Leu	Arg	Phe	Ala	Lys	Leu	Asp	Phe	Asn	Leu	Leu	Gln	Met	Leu	His	
225					230					235					240	
aaa	caa	gaa	ctt	gct	caa	gta	tca	agg	tgg	tgg	aaa	gat	ttg	gat	ttt	768
Lys	Gln	Glu	Leu	Ala	Gln	Val	Ser	Arg	Trp	Trp	Lys	Asp	Leu	Asp	Phe	
				245					250					255		
gta	aca	aca	ctt	cca	tat	gct	aga	gat	cga	gta	gtt	gaa	tgc	tac	ttt	816
Val	Thr	Thr	Leu	Pro	Tyr	Ala	Arg	Asp	Arg	Val	Val	Glu	Cys	Tyr	Phe	
			260					265					270			
tgg	gca	tta	gga	gtt	tat	ttt	gag	cct	caa	tac	tct	caa	gct	cgc	gtc	864
Trp	Ala	Leu	Gly	Val	Tyr	Phe	Glu	Pro	Gln	Tyr	Ser	Gln	Ala	Arg	Val	
		275					280					285				
atg	ctc	gtt	aag	acc	ata	tca	atg	att	tcg	att	gtc	gat	gac	acc	ttt	912
Met	Leu	Val	Lys	Thr	Ile	Ser	Met	Ile	Ser	Ile	Val	Asp	Asp	Thr	Phe	
	290					295					300					
gat	gct	tac	ggc	aca	gtt	aaa	gaa	ctt	gag	gca	tac	aca	gat	gcc	ata	960
Asp	Ala	Tyr	Gly	Thr	Val	Lys	Glu	Leu	Glu	Ala	Tyr	Thr	Asp	Ala	Ile	
305					310					315					320	
caa	aga	tgg	gat	atc	aac	gaa	att	gat	cgg	ctt	cct	gat	tac	atg	aaa	1008
Gln	Arg	Trp	Asp	Ile	Asn	Glu	Ile	Asp	Arg	Leu	Pro	Asp	Tyr	Met	Lys	
				325					330					335		
atc	agt	tat	aaa	gct	att	cta	gat	ctc	tac	aag	gat	tat	gaa	aag	gaa	1056
Ile	Ser	Tyr	Lys	Ala	Ile	Leu	Asp	Leu	Tyr	Lys	Asp	Tyr	Glu	Lys	Glu	
			340					345					350			
ttg	tct	agt	gcc	gga	aga	tct	cat	att	gtc	tgc	cat	gca	ata	gaa	aga	1104
Leu	Ser	Ser	Ala	Gly	Arg	Ser	His	Ile	Val	Cys	His	Ala	Ile	Glu	Arg	
		355					360					365				
atg	aaa	gaa	gta	gta	aga	aat	tat	aat	gtc	gag	tca	aca	tgg	ttt	att	1152
Met	Lys	Glu	Val	Val	Arg	Asn	Tyr	Asn	Val	Glu	Ser	Thr	Trp	Phe	Ile	
	370					375					380					

gaa gga tat atg cca cct gtt tct gaa tac cta agc aat gca cta gca	1200
Glu Gly Tyr Met- Pro Pro Val Ser Glu Tyr Leu Ser Asn Ala Leu Ala	
385 390 395 400	
act acc aca tat tac nns nns gcg aca aca tcg tat ttg ggc atg aag	1248
Thr Thr Thr Tyr Tyr Xaa Xaa Ala Thr Thr Ser Tyr Leu Gly Met Lys	
405 410 415	
tct gcc acg gag caa gat ttt gag tgg ttg tca aag aat cca aaa att	1296
Ser Ala Thr Glu Gln Asp Phe Glu Trp Leu Ser Lys Asn Pro Lys Ile	
420 425 430	
ctt gaa gct agt gta att ata tgt cga gtt atc gat gac aca gcc acg	1344
Leu Glu Ala Ser Val Ile Ile Cys Arg Val Ile Asp Asp Thr Ala Thr	
435 440 445	
tac gag gtt gag aaa agc agg gga caa att gca act gga att gag tgc	1392
Tyr Glu Val Glu Lys Ser Arg Gly Gln Ile Ala Thr Gly Ile Glu Cys	
450 455 460	
tgc atg aga gat tat ggt ata tca aca aaa gag gca atg gct aaa ttt	1440
Cys Met Arg Asp Tyr Gly Ile Ser Thr Lys Glu Ala Met Ala Lys Phe	
465 470 475 480	
caa aat atg gct gag aca gca tgg aaa gat att aat gaa gga ctt ctt	1488
Gln Asn Met Ala Glu Thr Ala Trp Lys Asp Ile Asn Glu Gly Leu Leu	
485 490 495	
agg ccc act ccc gtc tct aca gaa ttt tta act cct att ctc aat ctt	1536
Arg Pro Thr Pro Val Ser Thr Glu Phe Leu Thr Pro Ile Leu Asn Leu	
500 505 510	
gct cgt att gtt gag gtt aca tat ata cac aat cta gat gga tac act	1584
Ala Arg Ile Val Glu Val Thr Tyr Ile His Asn Leu Asp Gly Tyr Thr	
515 520 525	
cat ccg gag aaa gtc tta aaa cct cac att att aac cta ctt gtg gac	1632
His Pro Glu Lys Val Leu Lys Pro His Ile Ile Asn Leu Leu Val Asp	
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tcc atc aaa att	1644
Ser Ile Lys Ile	
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			20					25					30		
Ser	Ile	Asp	Asn	Gln	Val	Ala	Glu	Lys	Tyr	Ala	Gln	Glu	Ile	Glu	Ala
		35					40					45			
Leu	Lys	Glu	Gln	Thr	Arg	Ser	Met	Leu	Leu	Ala	Thr	Gly	Arg	Lys	Leu
	50					55					60				
Ala	Asp	Thr	Leu	Asn	Leu	Ile	Asp	Ile	Ile	Glu	Arg	Leu	Gly	Ile	Ser
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Tyr	His	Phe	Glu	Lys	Glu	Ile	Asp	Glu	Ile	Leu	Asp	Gln	Ile	Tyr	Asn
				85				90						95	
Gln	Asn	Ser	Asn	Cys	Asn	Asp	Leu	Cys	Thr	Ser	Ala	Leu	Gln	Phe	Arg
			100					105					110		
Leu	Leu	Arg	Gln	His	Gly	Phe	Asn	Ile	Ser	Pro	Glu	Ile	Phe	Ser	Lys
		115					120					125			
Phe	Gln	Asp	Glu	Asn	Gly	Lys	Phe	Lys	Glu	Ser	Leu	Ala	Ser	Asp	Val
	130					135					140				
Leu	Gly	Leu	Leu	Asn	Leu	Tyr	Glu	Ala	Ser	His	Val	Arg	Thr	His	Ala
145					150					155					160
Asp	Asp	Ile	Leu	Glu	Asp	Ala	Leu	Ala	Phe	Ser	Thr	Ile	His	Leu	Glu
				165					170					175	
Ser	Ala	Ala	Pro	His	Leu	Lys	Ser	Pro	Leu	Arg	Glu	Gln	Val	Thr	His
			180					185					190		
Ala	Leu	Glu	Gln	Cys	Leu	His	Lys	Gly	Val	Pro	Arg	Val	Glu	Thr	Arg
		195					200					205			
Phe	Phe	Ile	Ser	Ser	Ile	Tyr	Asp	Lys	Glu	Gln	Ser	Lys	Asn	Asn	Val
	210					215					220				
Leu	Leu	Arg	Phe	Ala	Lys	Leu	Asp	Phe	Asn	Leu	Leu	Gln	Met	Leu	His
225					230					235					240
Lys	Gln	Glu	Leu	Ala	Gln	Val	Ser	Arg	Trp	Trp	Lys	Asp	Leu	Asp	Phe
				245					250					255	
Val	Thr	Thr	Leu	Pro	Tyr	Ala	Arg	Asp	Arg	Val	Val	Glu	Cys	Tyr	Phe
			260					265					270		
Trp	Ala	Leu	Gly	Val	Tyr	Phe	Glu	Pro	Gln	Tyr	Ser	Gln	Ala	Arg	Val
		275					280					285			
Met	Leu	Val	Lys	Thr	Ile	Ser	Met	Ile	Ser	Ile	Val	Asp	Asp	Thr	Phe
	290					295					300				
Asp	Ala	Tyr	Gly	Thr	Val	Lys	Glu	Leu	Glu	Ala	Tyr	Thr	Asp	Ala	Ile
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Gln	Arg	Trp	Asp	Ile	Asn	Glu	Ile	Asp	Arg	Leu	Pro	Asp	Tyr	Met	Lys
				325					330					335	
Ile	Ser	Tyr	Lys	Ala	Ile	Leu	Asp	Leu	Tyr	Lys	Asp	Tyr	Glu	Lys	Glu
			340					345					350		
Leu	Ser	Ser	Ala	Gly	Arg	Ser	His	Ile	Val	Cys	His	Ala	Ile	Glu	Arg
		355					360					365			
Met	Lys	Glu	Val	Val	Arg	Asn	Tyr	Asn	Val	Glu	Ser	Thr	Trp	Phe	Ile
	370					375					380				
Glu	Gly	Tyr	Met	Pro	Pro	Val	Ser	Glu	Tyr	Leu	Ser	Asn	Ala	Leu	Ala
385					390					395					400
Thr	Thr	Thr	Tyr	Tyr	Xaa	Xaa	Ala	Thr	Thr	Ser	Tyr	Leu	Gly	Met	Lys
				405					410					415	
Ser	Ala	Thr	Glu	Gln	Asp	Phe	Glu	Trp	Leu	Ser	Lys	Asn	Pro	Lys	Ile
			420					425					430		
Leu	Glu	Ala	Ser	Val	Ile	Ile	Cys	Arg	Val	Ile	Asp	Asp	Thr	Ala	Thr

	435					440				445					
Tyr	Glu	Val	Glu	Lys	Ser	Arg	Gly	Gln	Ile	Ala	Thr	Gly	Ile	Glu	Cys
	450					455					460				
Cys	Met	Arg	Asp	Tyr	Gly	Ile	Ser	Thr	Lys	Glu	Ala	Met	Ala	Lys	Phe
465					470					475					480
Gln	Asn	Met	Ala	Glu	Thr	Ala	Trp	Lys	Asp	Ile	Asn	Glu	Gly	Leu	Leu
			485						490					495	
Arg	Pro	Thr	Pro	Val	Ser	Thr	Glu	Phe	Leu	Thr	Pro	Ile	Leu	Asn	Leu
			500					505					510		
Ala	Arg	Ile	Val	Glu	Val	Thr	Tyr	Ile	His	Asn	Leu	Asp	Gly	Tyr	Thr
		515					520					525			
His	Pro	Glu	Lys	Val	Leu	Lys	Pro	His	Ile	Ile	Asn	Leu	Leu	Val	Asp
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 <223> primer

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33

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33

<210> 17
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54

<210> 18
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 <212> DNA
 <213> Artificial Sequence
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<210> 19
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 <212> DNA
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 <222> (6)...(1892)
 <223> pinene synthase

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 1 5 10 15

50

cac aaa tcg ttg atc agt tct acc cat gag ctt aag gct ctc tct aga
 His Lys Ser Leu Ile Ser Ser Thr His Glu Leu Lys Ala Leu Ser Arg
 20 25 30

98

aca	att	cca	gct	cta	gga	atg	agt	agg	cga	ggg	aaa	tct	atc	act	cct	146
Thr	Ile	Pro	Ala	Leu	Gly	Met	Ser	Arg	Arg	Gly	Lys	Ser	Ile	Thr	Pro	
			35					40					45			
tcc	atc	agc	atg	agc	tct	acc	acc	gtt	gta	acc	gat	gat	ggg	gta	cga	194
Ser	Ile	Ser	Met	Ser	Ser	Thr	Thr	Val	Val	Thr	Asp	Asp	Gly	Val	Arg	
		50					55					60				
aga	cgc	atg	ggc	gat	ttc	cat	tcc	aac	ctc	tgg	gac	gat	gat	gtc	ata	242
Arg	Arg	Met	Gly	Asp	Phe	His	Ser	Asn	Leu	Trp	Asp	Asp	Asp	Val	Ile	
	65					70					75					
cag	tct	tta	cca	acg	gct	tat	gag	gaa	aaa	tcg	tac	ctg	gag	cgt	gct	290
Gln	Ser	Leu	Pro	Thr	Ala	Tyr	Glu	Glu	Lys	Ser	Tyr	Leu	Glu	Arg	Ala	
80					85					90					95	
gag	aaa	ctg	atc	ggg	gaa	gta	aag	aac	atg	ttc	aat	tcg	atg	tca	tta	338
Glu	Lys	Leu	Ile	Gly	Glu	Val	Lys	Asn	Met	Phe	Asn	Ser	Met	Ser	Leu	
				100					105					110		
gaa	gat	gga	gag	tta	atg	agt	ccg	ctc	aat	gat	ctc	att	caa	cgc	ctt	386
Glu	Asp	Gly	Glu	Leu	Met	Ser	Pro	Leu	Asn	Asp	Leu	Ile	Gln	Arg	Leu	
			115					120					125			
tgg	att	gtc	gac	agc	ctt	gaa	cgt	ttg	ggg	atc	cat	aga	cat	ttc	aaa	434
Trp	Ile	Val	Asp	Ser	Leu	Glu	Arg	Leu	Gly	Ile	His	Arg	His	Phe	Lys	
		130					135					140				
gat	gag	ata	aaa	tcg	gcg	ctt	gat	tat	gtt	tac	agt	tat	tgg	ggc	gaa	482
Asp	Glu	Ile	Lys	Ser	Ala	Leu	Asp	Tyr	Val	Tyr	Ser	Tyr	Trp	Gly	Glu	
	145					150					155					
aat	ggc	atc	gga	tgc	ggg	agg	gag	agt	gtt	gtt	act	gat	ctg	aac	tca	530
Asn	Gly	Ile	Gly	Cys	Gly	Arg	Glu	Ser	Val	Val	Thr	Asp	Leu	Asn	Ser	
160					165					170					175	
act	gcg	ttg	ggg	ctt	cga	acc	cta	cga	cta	cac	gga	tac	ccg	gtg	tct	578
Thr	Ala	Leu	Gly	Leu	Arg	Thr	Leu	Arg	Leu	His	Gly	Tyr	Pro	Val	Ser	
				180					185					190		
tca	gat	gtt	ttc	aaa	gct	ttc	aaa	ggc	caa	aat	ggg	cag	ttt	tcc	tgc	626
Ser	Asp	Val	Phe	Lys	Ala	Phe	Lys	Gly	Gln	Asn	Gly	Gln	Phe	Ser	Cys	
			195					200					205			
tct	gaa	aat	att	cag	aca	gat	gaa	gag	atc	aga	ggc	gtt	ctg	aat	tta	674
Ser	Glu	Asn	Ile	Gln	Thr	Asp	Glu	Glu	Ile	Arg	Gly	Val	Leu	Asn	Leu	
		210					215					220				
ttc	cgg	gcc	tcc	ctc	att	gcc	ttt	cca	ggg	gag	aaa	att	atg	gat	gag	722
Phe	Arg	Ala	Ser	Leu	Ile	Ala	Phe	Pro	Gly	Glu	Lys	Ile	Met	Asp	Glu	
	225					230					235					

gct gaa atc ttc tct acc aaa tat tta aaa gaa gcc ctg caa aag att Ala Glu Ile Phe Ser Thr Lys Tyr Leu Lys Glu Ala Leu Gln Lys Ile 240 245 250 255	770
ccg gtc tcc agt ctt tcg cga gag atc ggg gac gtt ttg gaa tat ggt Pro Val Ser Ser Leu Ser Arg Glu Ile Gly Asp Val Leu Glu Tyr Gly 260 265 270	818
tgg cac aca tat ttg ccg cga ttg gaa gca agg aat tac atc caa gtc Trp His Thr Tyr Leu Pro Arg Leu Glu Ala Arg Asn Tyr Ile Gln Val 275 280 285	866
ttt gga cag gac act gag aac acg aag tca tat gtg aag agc aaa aaa Phe Gly Gln Asp Thr Glu Asn Thr Lys Ser Tyr Val Lys Ser Lys Lys 290 295 300	914
ctt tta gaa ctc gca aaa ttg gag ttc aac atc ttt caa tcc tta caa Leu Leu Glu Leu Ala Lys Leu Glu Phe Asn Ile Phe Gln Ser Leu Gln 305 310 315	962
aag agg gag tta gaa agt ctg gtc aga tgg tgg aaa gaa tcg ggt ttt Lys Arg Glu Leu Glu Ser Leu Val Arg Trp Trp Lys Glu Ser Gly Phe 320 325 330 335	1010
cct gag atg acc ttc tgc cga cat cgt cac gtg gaa tac tac act ttg Pro Glu Met Thr Phe Cys Arg His Arg His Val Glu Tyr Tyr Thr Leu 340 345 350	1058
gct tcc tgc att gcg ttc gag cct caa cat tct gga ttc aga ctc ggc Ala Ser Cys Ile Ala Phe Glu Pro Gln His Ser Gly Phe Arg Leu Gly 355 360 365	1106
ttt gcc aag acg tgt cat ctt atc acg gtt ctt gac gat atg tac gac Phe Ala Lys Thr Cys His Leu Ile Thr Val Leu Asp Asp Met Tyr Asp 370 375 380 385	1154
acc ttc ggc aca gta gac gag ctg gaa ctc ttc aca gcg aca atg aag Thr Phe Gly Thr Val Asp Glu Leu Glu Leu Phe Thr Ala Thr Met Lys 385 390 395	1202
aga tgg gat ccg tcc tcg ata gat tgc ctt cca gaa tat atg aaa gga Arg Trp Asp Pro Ser Ser Ile Asp Cys Leu Pro Glu Tyr Met Lys Gly 400 405 410 415	1250
gtg tac ata gcg gtt tac gac acc gta aat gaa atg gct cga gag gca Val Tyr Ile Ala Val Tyr Asp Thr Val Asn Glu Met Ala Arg Glu Ala 420 425 430	1298
gag gag gct caa ggc cga gat acg ctc aca tat gct cgg gaa gct tgg Glu Glu Ala Gln Gly Arg Asp Thr Leu Thr Tyr Ala Arg Glu Ala Trp 435 440 445	1346
gag gct tat att gat tcg tat atg caa gaa gca agg tgg atc gcc act	1394

Glu	Ala	Tyr	Ile	Asp	Ser	Tyr	Met	Gln	Glu	Ala	Arg	Trp	Ile	Ala	Thr		
	450						455					460					
ggt	tac	ctg	ccc	tcc	ttt	gat	gag	tac	tac	gag	aat	ggg	aaa	ggt	agc		1442
Gly	Tyr	Leu	Pro	Ser	Phe	Asp	Glu	Tyr	Tyr	Glu	Asn	Gly	Lys	Val	Ser		
	465					470					475						
tgt	ggt	cat	cgc	ata	tcc	gca	ttg	caa	ccc	att	ctg	aca	atg	gac	atc		1490
Cys	Gly	His	Arg	Ile	Ser	Ala	Leu	Gln	Pro	Ile	Leu	Thr	Met	Asp	Ile		
	480				485					490					495		
ccc	ttt	cct	gat	cat	atc	ctc	aag	gaa	ggt	gac	ttc	cca	tca	aag	ctt		1538
Pro	Phe	Pro	Asp	His	Ile	Leu	Lys	Glu	Val	Asp	Phe	Pro	Ser	Lys	Leu		
				500					505					510			
aac	gac	ttg	gca	tgt	gcc	atc	ctt	cga	tta	cga	ggt	gat	acg	cgg	tgc		1586
Asn	Asp	Leu	Ala	Cys	Ala	Ile	Leu	Arg	Leu	Arg	Gly	Asp	Thr	Arg	Cys		
			515					520					525				
tac	aag	gcg	gac	agg	gct	cgt	gga	gaa	gaa	gct	tcc	tct	ata	tca	tgt		1634
Tyr	Lys	Ala	Asp	Arg	Ala	Arg	Gly	Glu	Glu	Ala	Ser	Ser	Ile	Ser	Cys		
		530					535					540					
tat	atg	aaa	gac	aat	cct	gga	gta	tca	gag	gaa	gat	gct	ctc	gat	cat		1682
Tyr	Met	Lys	Asp	Asn	Pro	Gly	Val	Ser	Glu	Glu	Asp	Ala	Leu	Asp	His		
	545					550					555						
atc	aac	gcc	atg	atc	agt	gac	gta	atc	aaa	gga	tta	aat	tgg	gaa	ctt		1730
Ile	Asn	Ala	Met	Ile	Ser	Asp	Val	Ile	Lys	Gly	Leu	Asn	Trp	Glu	Leu		
	560				565					570					575		
ctc	aaa	cca	gac	atc	aat	ggt	ccc	atc	tcg	gcg	aag	aaa	cat	gct	ttt		1778
Leu	Lys	Pro	Asp	Ile	Asn	Val	Pro	Ile	Ser	Ala	Lys	Lys	His	Ala	Phe		
				580					585					590			
gac	atc	gcc	aga	gct	ttc	cat	tac	ggc	tac	aaa	tac	cga	gac	ggc	tac		1826
Asp	Ile	Ala	Arg	Ala	Phe	His	Tyr	Gly	Tyr	Lys	Tyr	Arg	Asp	Gly	Tyr		
			595					600					605				
agc	gtt	gcc	aac	gtt	gaa	acg	aag	agt	ttg	gtc	acg	aga	acc	ctc	ctt		1874
Ser	Val	Ala	Asn	Val	Glu	Thr	Lys	Ser	Leu	Val	Thr	Arg	Thr	Leu	Leu		
		610					615					620					
gaa	tct	gtg	cct	ttg	tag	caacagctca	aatctatgcc	ctatgctatg									1922
Glu	Ser	Val	Pro	Leu	*												
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<213> Abies grandis

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Ile Ser Met Ser Ser Thr Thr Val Val Thr Asp Asp Gly Val Arg Arg
50 55 60
Arg Met Gly Asp Phe His Ser Asn Leu Trp Asp Asp Asp Val Ile Gln
65 70 75 80
Ser Leu Pro Thr Ala Tyr Glu Glu Lys Ser Tyr Leu Glu Arg Ala Glu
85 90 95
Lys Leu Ile Gly Glu Val Lys Asn Met Phe Asn Ser Met Ser Leu Glu
100 105 110
Asp Gly Glu Leu Met Ser Pro Leu Asn Asp Leu Ile Gln Arg Leu Trp
115 120 125
Ile Val Asp Ser Leu Glu Arg Leu Gly Ile His Arg His Phe Lys Asp
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Glu Ile Lys Ser Ala Leu Asp Tyr Val Tyr Ser Tyr Trp Gly Glu Asn
145 150 155 160
Gly Ile Gly Cys Gly Arg Glu Ser Val Val Thr Asp Leu Asn Ser Thr
165 170 175
Ala Leu Gly Leu Arg Thr Leu Arg Leu His Gly Tyr Pro Val Ser Ser
180 185 190
Asp Val Phe Lys Ala Phe Lys Gly Gln Asn Gly Gln Phe Ser Cys Ser
195 200 205
Glu Asn Ile Gln Thr Asp Glu Glu Ile Arg Gly Val Leu Asn Leu Phe
210 215 220
Arg Ala Ser Leu Ile Ala Phe Pro Gly Glu Lys Ile Met Asp Glu Ala
225 230 235 240
Glu Ile Phe Ser Thr Lys Tyr Leu Lys Glu Ala Leu Gln Lys Ile Pro
245 250 255
Val Ser Ser Leu Ser Arg Glu Ile Gly Asp Val Leu Glu Tyr Gly Trp
260 265 270
His Thr Tyr Leu Pro Arg Leu Glu Ala Arg Asn Tyr Ile Gln Val Phe
275 280 285
Gly Gln Asp Thr Glu Asn Thr Lys Ser Tyr Val Lys Ser Lys Lys Leu
290 295 300
Leu Glu Leu Ala Lys Leu Glu Phe Asn Ile Phe Gln Ser Leu Gln Lys
305 310 315 320
Arg Glu Leu Glu Ser Leu Val Arg Trp Trp Lys Glu Ser Gly Phe Pro
325 330 335
Glu Met Thr Phe Cys Arg His Arg His Val Glu Tyr Tyr Thr Leu Ala
340 345 350
Ser Cys Ile Ala Phe Glu Pro Gln His Ser Gly Phe Arg Leu Gly Phe
355 360 365
Ala Lys Thr Cys His Leu Ile Thr Val Leu Asp Asp Met Tyr Asp Thr
370 375 380
Phe Gly Thr Val Asp Glu Leu Glu Leu Phe Thr Ala Thr Met Lys Arg
385 390 395 400

Trp	Asp	Pro	Ser	Ser	Ile	Asp	Cys	Leu	Pro	Glu	Tyr	Met	Lys	Gly	Val	
				405					410					415		
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			420					425					430			
Glu	Ala	Gln	Gly	Arg	Asp	Thr	Leu	Thr	Tyr	Ala	Arg	Glu	Ala	Trp	Glu	
		435					440					445				
Ala	Tyr	Ile	Asp	Ser	Tyr	Met	Gln	Glu	Ala	Arg	Trp	Ile	Ala	Thr	Gly	
	450					455					460					
Tyr	Leu	Pro	Ser	Phe	Asp	Glu	Tyr	Tyr	Glu	Asn	Gly	Lys	Val	Ser	Cys	
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Gly	His	Arg	Ile	Ser	Ala	Leu	Gln	Pro	Ile	Leu	Thr	Met	Asp	Ile	Pro	
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Phe	Pro	Asp	His	Ile	Leu	Lys	Glu	Val	Asp	Phe	Pro	Ser	Lys	Leu	Asn	
			500					505					510			
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Lys	Ala	Asp	Arg	Ala	Arg	Gly	Glu	Glu	Ala	Ser	Ser	Ile	Ser	Cys	Tyr	
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Met	Lys	Asp	Asn	Pro	Gly	Val	Ser	Glu	Glu	Asp	Ala	Leu	Asp	His	Ile	
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Asn	Ala	Met	Ile	Ser	Asp	Val	Ile	Lys	Gly	Leu	Asn	Trp	Glu	Leu	Leu	
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Lys	Pro	Asp	Ile	Asn	Val	Pro	Ile	Ser	Ala	Lys	Lys	His	Ala	Phe	Asp	
			580					585					590			
Ile	Ala	Arg	Ala	Phe	His	Tyr	Gly	Tyr	Lys	Tyr	Arg	Asp	Gly	Tyr	Ser	
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Val	Ala	Asn	Val	Glu	Thr	Lys	Ser	Leu	Val	Thr	Arg	Thr	Leu	Leu	Glu	
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 <212> DNA
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 <222> (29)...(1828)
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			1				5									
gca	act	caa	atg	gcg	att	cct	agc	aac	cta	acg	aca	tgt	ctt	caa	ccc	100
Ala	Thr	Gln	Met	Ala	Ile	Pro	Ser	Asn	Leu	Thr	Thr	Cys	Leu	Gln	Pro	
	10					15					20					
tca	cac	ttc	aaa	tct	tct	cca	aaa	ctg	tta	tct	agc	act	aac	agt	agt	148
Ser	His	Phe	Lys	Ser	Ser	Pro	Lys	Leu	Leu	Ser	Ser	Thr	Asn	Ser	Ser	
	25				30					35					40	

agt	cgg	tct	cgc	ctc	cgt	gtg	tat	tgc	tcc	tcc	tcg	caa	ctc	act	act	196
Ser	Arg	Ser	Arg	Leu	Arg	Val	Tyr	Cys	Ser	Ser	Ser	Gln	Leu	Thr	Thr	
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gaa	aga	cga	tcc	gga	aac	tac	aac	cct	tct	cgt	tgg	gat	gtc	aac	ttc	244
Glu	Arg	Arg	Ser	Gly	Asn	Tyr	Asn	Pro	Ser	Arg	Trp	Asp	Val	Asn	Phe	
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atc	caa	tcg	ctt	ctc	agt	gac	tat	aag	gag	gac	aaa	cac	gtg	att	agg	202
Ile	Gln	Ser	Leu	Leu	Ser	Asp	Tyr	Lys	Glu	Asp	Lys	His	Val	Ile	Arg	
		75					80					85				
gct	tct	gag	ctg	gtc	act	ttg	gtg	aag	atg	gaa	ctg	gag	aaa	gaa	acg	340
Ala	Ser	Glu	Leu	Val	Thr	Leu	Val	Lys	Met	Glu	Leu	Glu	Lys	Glu	Thr	
	90					95					100					
gat	caa	att	cga	caa	ctt	gag	ttg	atc	gat	gac	ttg	cag	agg	atg	ggg	388
Asp	Gln	Ile	Arg	Gln	Leu	Glu	Leu	Ile	Asp	Asp	Leu	Gln	Arg	Met	Gly	
105					110					115					120	
ctg	tcc	gat	cat	ttc	caa	aat	gag	ttc	aaa	gaa	atc	ttg	tcc	tct	ata	436
Leu	Ser	Asp	His	Phe	Gln	Asn	Glu	Phe	Lys	Glu	Ile	Leu	Ser	Ser	Ile	
				125					130					135		
tat	ctc	gac	cat	cac	tat	tac	aag	aac	cct	ttt	cca	aaa	gaa	gaa	agg	484
Tyr	Leu	Asp	His	His	Tyr	Tyr	Lys	Asn	Pro	Phe	Pro	Lys	Glu	Glu	Arg	
			140					145					150			
gat	ctc	tac	tcc	aca	tct	ctt	gca	ttt	agg	ctc	ctc	aga	gaa	cat	ggc	532
Asp	Leu	Tyr	Ser	Thr	Ser	Leu	Ala	Phe	Arg	Leu	Leu	Arg	Glu	His	Gly	
		155					160					165				
ttt	caa	gtc	gca	caa	gag	gta	ttc	gat	agt	ttc	aag	aac	gag	gag	ggc	580
Phe	Gln	Val	Ala	Gln	Glu	Val	Phe	Asp	Ser	Phe	Lys	Asn	Glu	Glu	Gly	
	170					175					180					
gag	ttc	aaa	gaa	agc	ctt	agc	gac	gac	acc	aga	gga	ttg	ttg	caa	ctg	628
Glu	Phe	Lys	Glu	Ser	Leu	Ser	Asp	Asp	Thr	Arg	Gly	Leu	Leu	Gln	Leu	
185					190					195					200	
tat	gaa	gct	tcc	ttt	ctg	ttg	acg	gaa	ggc	gaa	acc	acg	ctc	gag	tca	676
Tyr	Glu	Ala	Ser	Phe	Leu	Leu	Thr	Glu	Gly	Glu	Thr	Thr	Leu	Glu	Ser	
				205					210					215		
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Ala	Arg	Glu	Phe	Ala	Thr	Lys	Phe	Leu	Glu	Glu	Lys	Val	Asn	Glu	Gly	
			220					225					230			
ggc	gtt	gat	ggc	gac	ctt	tta	aca	aga	atc	gca	tat	tct	ttg	gac	atc	772
Gly	Val	Asp	Gly	Asp	Leu	Leu	Thr	Arg	Ile	Ala	Tyr	Ser	Leu	Asp	Ile	
		235					240					245				

cct Pro 250	ctt Leu 250	cat His	tgg Trp	agg Arg	att Ile	aaa Lys 255	agg Arg	cca Pro	aat Asn	gca Ala 260	cct Pro 260	gtg Val	tgg Trp	atc Ile	gaa Glu	820
tgg Trp 265	tat Tyr	agg Arg	aag Lys	agg Arg	ccc Pro 270	gac Asp	atg Met	aat Asn	cca Pro	gta Val 275	gtg Val	ttg Leu	gag Glu	ctt Leu	gcc Ala 280	868
ata Ile	ctc Leu	gac Asp	tta Leu	aat Asn 285	att Ile	gtt Val	caa Gln	gca Ala	caa Gln 290	ttt Phe	caa Gln	gaa Glu	gag Glu	ctc Leu 295	aaa Lys	916
gaa Glu	tcc Ser	ttc Phe	agg Arg 300	tgg Trp	tgg Trp	aga Arg	aat Asn	act Thr 305	ggg Gly	ttt Phe	gtt Val	gag Glu	aag Lys 310	ctg Leu	ccc Pro	964
ttc Phe	gca Ala 315	agg Arg	gat Asp	aga Arg	ctg Leu	gtg Val	gaa Glu 320	tgc Cys	tac Tyr	ttt Phe	tgg Trp	aat Asn 325	act Thr	ggg Gly	atc Ile	1012
atc Ile 330	gag Glu	cca Pro	cgt Arg	cag Gln	cat His	gca Ala 335	agt Ser	gca Ala	agg Arg	ata Ile	atg Met 340	atg Met	ggc Gly	aaa Lys	gtc Val	1060
aac Asn 345	gct Ala	ctg Leu	att Ile	acg Thr	gtg Val 350	atc Ile	gat Asp	gat Asp	att Ile	tat Tyr 355	gat Asp	gtc Val	tat Tyr	ggc Gly	acc Thr 360	1108
tta Leu	gaa Glu	gaa Glu	ctc Leu	gaa Glu 365	caa Gln	ttc Phe	act Thr	gac Asp	ctc Leu 370	att Ile	cga Arg	aga Arg	tgg Trp	gat Asp 375	ata Ile	1156
aac Asn	tca Ser	atc Ile	gac Asp 380	caa Gln	ctt Leu	ccc Pro	gat Asp	tac Tyr 385	atg Met	caa Gln	ctg Leu	tgc Cys	ttt Phe 390	ctt Leu	gca Ala	1204
ctc Leu	aac Asn	aac Asn 395	ttc Phe	gtc Val	gat Asp	gat Asp	aca Thr 400	tgc Ser	tac Tyr	gat Asp	gtt Val	atg Met 405	aag Lys	gag Glu	aaa Lys	1252
ggc Gly 410	gtc Val	aac Asn	gtt Val	ata Ile	ccc Pro	tac Tyr 415	ctg Leu	cgg Arg	caa Gln	tgc Ser	tgg Trp 420	gtt Val	gat Asp	ttg Leu	gcg Ala	1300
gat Asp 425	aag Lys	tat Tyr	atg Met	gta Val	gag Glu 430	gca Ala	cgg Arg	tgg Trp	ttc Phe	tac Tyr 435	ggc Gly	ggg Gly	cac His	aaa Lys	cca Pro 440	1348
agt Ser	ttg Leu	gaa Glu	gag Glu	tat Tyr 445	ttg Leu	gag Glu	aac Asn	tca Ser	tgg Trp 450	cag Gln	tgc Ser	ata Ile	agt Ser	ggg Gly 455	ccc Pro	1396
tgt atg	tta aca	acg cac	ata ttc	ttc cga	gta aca	gat tcg	ttc aca	aag								1444

Cys	Met	Leu	Thr	His	Ile	Phe	Phe	Arg	Val	Thr	Asp	Ser	Phe	Thr	Lys		
			460					465					470				
gag	acc	gtc	gac	agt	ttg	tac	aaa	tac	cac	gat	tta	gtt	cgt	tgg	tca	1492	
Glu	Thr	Val	Asp	Ser	Leu	Tyr	Lys	Tyr	His	Asp	Leu	Val	Arg	Trp	Ser		
		475					480					485					
tcc	ttc	gtt	ctg	cgg	ctt	gct	gat	gat	ttg	gga	acc	tcg	gtg	gaa	gag	1540	
Ser	Phe	Val	Leu	Arg	Leu	Ala	Asp	Asp	Leu	Gly	Thr	Ser	Val	Glu	Glu		
		490				495					500						
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Val	Ser	Arg	Gly	Asp	Val	Pro	Lys	Ser	Leu	Gln	Cys	Tyr	Met	Ser	Asp		
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tac	aat	gca	tcg	gag	gcg	gag	gcg	cgg	aag	cac	gtg	aaa	tgg	ctg	ata	1636	
Tyr	Asn	Ala	Ser	Glu	Ala	Glu	Ala	Arg	Lys	His	Val	Lys	Trp	Leu	Ile		
				525					530					535			
gcg	gag	gtg	tgg	aag	aag	atg	aat	gcg	gag	agg	gtg	tcg	aag	gat	tct	1684	
Ala	Glu	Val	Trp	Lys	Lys	Met	Asn	Ala	Glu	Arg	Val	Ser	Lys	Asp	Ser		
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cca	ttc	ggc	aaa	gat	ttt	ata	gga	tgt	gca	gtt	gat	tta	gga	agg	atg	1732	
Pro	Phe	Gly	Lys	Asp	Phe	Ile	Gly	Cys	Ala	Val	Asp	Leu	Gly	Arg	Met		
		555					560					565					
gcg	cag	ttg	atg	tac	cat	aat	gga	gat	ggg	cac	ggc	aca	caa	cac	cct	1780	
Ala	Gln	Leu	Met	Tyr	His	Asn	Gly	Asp	Gly	His	Gly	Thr	Gln	His	Pro		
		570				575					580						
att	ata	cat	caa	caa	atg	acc	aga	acc	tta	ttc	gag	ccc	ttt	gca	tga	1828	
Ile	Ile	His	Gln	Gln	Met	Thr	Arg	Thr	Leu	Phe	Glu	Pro	Phe	Ala	*		
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gccaccacgt	gagcacaagg	gagagtctgt	cgtcgtttat	ggatgaacta	ttcaattttt	2008											
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<210> 22
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 <213> *Mentha spicata*

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 20 25 30
 Leu Leu Ser Ser Thr Asn Ser Ser Ser Arg Ser Arg Leu Arg Val Tyr

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Cys	Ser	Ser	Ser-Gln	Leu	Thr	Thr	Glu	Arg	Arg	Ser	Gly	Asn	Tyr	Asn
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Pro	Ser	Arg	Trp	Asp	Val	Asn	Phe	Ile	Gln	Ser	Leu	Leu	Ser	Asp
65					70					75				80
Lys	Glu	Asp	Lys	His	Val	Ile	Arg	Ala	Ser	Glu	Leu	Val	Thr	Leu
				85					90					95
Lys	Met	Glu	Leu	Glu	Lys	Glu	Thr	Asp	Gln	Ile	Arg	Gln	Leu	Glu
			100					105					110	Leu
Ile	Asp	Asp	Leu	Gln	Arg	Met	Gly	Leu	Ser	Asp	His	Phe	Gln	Asn
		115					120					125		Glu
Phe	Lys	Glu	Ile	Leu	Ser	Ser	Ile	Tyr	Leu	Asp	His	His	Tyr	Tyr
	130					135					140			Lys
Asn	Pro	Phe	Pro	Lys	Glu	Glu	Arg	Asp	Leu	Tyr	Ser	Thr	Ser	Leu
145					150					155				Ala
Phe	Arg	Leu	Leu	Arg	Glu	His	Gly	Phe	Gln	Val	Ala	Gln	Glu	Val
				165					170					Phe
Asp	Ser	Phe	Lys	Asn	Glu	Glu	Gly	Glu	Phe	Lys	Glu	Ser	Leu	Ser
			180					185					190	Asp
Asp	Thr	Arg	Gly	Leu	Leu	Gln	Leu	Tyr	Glu	Ala	Ser	Phe	Leu	Leu
		195					200					205		Thr
Glu	Gly	Glu	Thr	Thr	Leu	Glu	Ser	Ala	Arg	Glu	Phe	Ala	Thr	Lys
	210					215					220			Phe
Leu	Glu	Glu	Lys	Val	Asn	Glu	Gly	Gly	Val	Asp	Gly	Asp	Leu	Leu
225					230					235				Thr
Arg	Ile	Ala	Tyr	Ser	Leu	Asp	Ile	Pro	Leu	His	Trp	Arg	Ile	Lys
				245					250					Arg
Pro	Asn	Ala	Pro	Val	Trp	Ile	Glu	Trp	Tyr	Arg	Lys	Arg	Pro	Asp
			260					265					270	Met
Asn	Pro	Val	Val	Leu	Glu	Leu	Ala	Ile	Leu	Asp	Leu	Asn	Ile	Val
		275					280					285		Gln
Ala	Gln	Phe	Gln	Glu	Glu	Leu	Lys	Glu	Ser	Phe	Arg	Trp	Trp	Arg
	290					295					300			Asn
Thr	Gly	Phe	Val	Glu	Lys	Leu	Pro	Phe	Ala	Arg	Asp	Arg	Leu	Val
305					310					315				Glu
Cys	Tyr	Phe	Trp	Asn	Thr	Gly	Ile	Ile	Glu	Pro	Arg	Gln	His	Ala
				325					330					Ser
Ala	Arg	Ile	Met	Met	Gly	Lys	Val	Asn	Ala	Leu	Ile	Thr	Val	Ile
			340					345					350	Asp
Asp	Ile	Tyr	Asp	Val	Tyr	Gly	Thr	Leu	Glu	Glu	Leu	Glu	Gln	Phe
		355					360					365		Thr
Asp	Leu	Ile	Arg	Arg	Trp	Asp	Ile	Asn	Ser	Ile	Asp	Gln	Leu	Pro
	370					375					380			Asp
Tyr	Met	Gln	Leu	Cys	Phe	Leu	Ala	Leu	Asn	Asn	Phe	Val	Asp	Asp
385					390					395				Thr
Ser	Tyr	Asp	Val	Met	Lys	Glu	Lys	Gly	Val	Asn	Val	Ile	Pro	Tyr
				405					410					Leu
Arg	Gln	Ser	Trp	Val	Asp	Leu	Ala	Asp	Lys	Tyr	Met	Val	Glu	Ala
			420					425					430	Arg
Trp	Phe	Tyr	Gly	Gly	His	Lys	Pro	Ser	Leu	Glu	Glu	Tyr	Leu	Glu
		435					440					445		Asn
Ser	Trp	Gln	Ser	Ile	Ser	Gly	Pro	Cys	Met	Leu	Thr	His	Ile	Phe
	450					455								Phe

Arg	Val	Thr	Asp	Ser	Phe	Thr	Lys	Glu	Thr	Val	Asp	Ser	Leu	Tyr	Lys
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Tyr	His	Asp	Leu	Val	Arg	Trp	Ser	Ser	Phe	Val	Leu	Arg	Leu	Ala	Asp
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Asp	Leu	Gly	Thr	Ser	Val	Glu	Glu	Val	Ser	Arg	Gly	Asp	Val	Pro	Lys
			500					505					510		
Ser	Leu	Gln	Cys	Tyr	Met	Ser	Asp	Tyr	Asn	Ala	Ser	Glu	Ala	Glu	Ala
		515					520					525			
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Ala	Glu	Arg	Val	Ser	Lys	Asp	Ser	Pro	Phe	Gly	Lys	Asp	Phe	Ile	Gly
545					550					555					560
Cys	Ala	Val	Asp	Leu	Gly	Arg	Met	Ala	Gln	Leu	Met	Tyr	His	Asn	Gly
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Asp	Gly	His	Gly	Thr	Gln	His	Pro	Ile	Ile	His	Gln	Gln	Met	Thr	Arg
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Thr	Leu	Phe	Glu	Pro	Phe	Ala									
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 <213> Salvia officinalis

<220>
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<400> 23

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	1				5						10					
gcc	aaa	att	ttt	cac	aat	aac	tta	ttc	agc	gtg	att	tca	aaa	cga	cat	99
Ala	Lys	Ile	Phe	His	Asn	Asn	Leu	Phe	Ser	Val	Ile	Ser	Lys	Arg	His	
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Tyr	Gln	Pro	Thr	Leu	Trp	Asp	Phe	Ser	Thr	Ile	Gln	Leu	Phe	Asp	Ser	
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tac Ile	atg Thr	aat Asn	gag Glu	aag Lys	aat Asn	gct Ala	tcg Glu	gaa Glu	gaa Glu	gaa Glu	gcg Arg	cga Arg	gag Glu	cat Tyr	gtg Trp	1587

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aga Arg	atg Met	gcg Ala 560	caa Gln	tgg Trp	ata Ile	tac Tyr	cag Gln 565	cat His	gaa Glu	tct Ser	gat Asp	gga Gly 570	ttt Phe	ggc Gly	atg Met	1731
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tat Tyr 590	gag Glu	taa	cta	atc	cttcg	cccg	gggttc	aaat	gaatca	atct	gtt	gtg				1828
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Thr	Thr	Ile	Thr	Thr	Arg	Gly	Gly	Arg 25	Trp	Ala	His	Cys	Ser	Leu	Gln	
Met	Gly	Asn	Glu	Ile	Gln	Thr	Gly	Arg 30	Arg	Thr	Gly	Gly	Tyr	Gln	Pro	
Thr 50	Leu	Trp	Asp	Phe	Ser	Thr	Ile	Gln 55	Leu	Phe	Asp	Ser	Glu	Tyr	Lys	
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Met	Leu	Leu	Gln	Glu	Glu	Val	Asp	Ser 100	Ile	Gln	Arg	Leu	Glu	Leu	Ile	
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Gln	Leu	Tyr	Glu	Ala	Ser	Phe	Leu	Ser	Ala	Gln	Gly	Glu	Glu	Thr	Leu	195	200	205
His	Leu	Ala	Arg	Asp	Phe	Ala	Thr	Lys	Phe	Leu	His	Lys	Arg	Val	Leu	210	215	220
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Ala	Lys	Leu	Asp	Phe	Asn	Met	Val	Gln	Ala	Gln	Phe	Gln	Gln	Glu	Leu	275	280	285
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Ser	Cys	Thr	Ile	Leu	Arg	Leu	Ala	Asp	Asp	Met	Gly	Thr	Ser	Leu	Asp	485	490	495
Glu	Val	Glu	Arg	Gly	Asp	Val	Pro	Lys	Ser	Val	Gln	Cys	Tyr	Met	Asn	500	505	510
Glu	Lys	Asn	Ala	Ser	Glu	Glu	Glu	Ala	Arg	Glu	His	Val	Arg	Ser	Leu	515	520	525
Ile	Asp	Gln	Thr	Trp	Lys	Met	Met	Asn	Lys	Glu	Met	Met	Thr	Ser	Ser	530	535	540
Phe	Ser	Lys	Tyr	Phe	Val	Gln	Val	Ser	Ala	Asn	Leu	Ala	Arg	Met	Ala	545	550	555
Gln	Trp	Ile	Tyr	Gln	His	Glu	Ser	Asp	Gly	Phe	Gly	Met	Gln	His	Ser	565	570	575
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580

585

590

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<211> 2024

<212> DNA

<213> *Salvia officinalis*

<220>

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<223> (+)-bornyl diphosphate synthase

<400> 25

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Leu	Val	Pro	Cys	Thr	Ala	Pro	Thr	Ala	Arg	Leu	Arg	Ala	Ser	Cys	Ser	
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Thr	Glu	Glu	Arg	His	Leu	Asp	Arg	Lys	Ala	Glu	Leu	Ile	Val	Gln	Val	
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Gln	Ser	Val	Glu	Ala	Arg	Trp	Phe	Ile	Asp	Ala	Tyr	Ala	Arg	Arg	Pro	
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Leu	Pro	Asp	Asp	Leu	Gly	Thr	Ser	Tyr	Phe	Glu	Leu	Ala	Arg	Gly	Asp	
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Glu	Glu	Ala	Val	Glu	His	Val	Lys	Phe	Leu	Ile	Arg	Glu	Ala	Trp	Lys	
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gat	atg	aac	acg	gcc	ata	gca	gcc	ggg	tat	ccg	ttt	ccg	gat	ggg	atg	1681
Asp	Met	Asn	Thr	Ala	Ile	Ala	Ala	Gly	Tyr	Pro	Phe	Pro	Asp	Gly	Met	
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Val	Ala	Gly	Ala	Ala	Asn	Ile	Gly	Arg	Val	Ala	Gln	Phe	Ile	Tyr	Leu	
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cac	gga	gat	ggg	ttt	ggc	gtg	caa	cac	tcg	aaa	acg	tac	gag	cat	atc	1777
His	Gly	Asp	Gly	Phe	Gly	Val	Gln	His	Ser	Lys	Thr	Tyr	Glu	His	Ile	

575

580

585

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 590 595

1827

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1887

1947

2007

2024

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<211> 598

<212> PRT

<213> Salvia officinalis

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Cys	Thr	Ala	Pro	Thr	Ala	Arg	Leu	Arg	Ala	Ser	Cys	Ser	Ser	Lys	Leu
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Gln	Glu	Ala	His	Gln	Ile	Arg	Arg	Ser	Gly	Asn	Tyr	Gln	Pro	Ala	Leu
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Trp	Asp	Ser	Asn	Tyr	Ile	Gln	Ser	Leu	Asn	Thr	Pro	Tyr	Thr	Glu	Glu
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Arg	His	Leu	Asp	Arg	Lys	Ala	Glu	Leu	Ile	Val	Gln	Val	Arg	Ile	Leu
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Val	Glu	Lys	Met	Asp	Leu	Tyr	Phe	Thr	Ala	Leu	Gly	Phe	Arg	Leu	Leu
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Arg	Gln	His	Gly	Phe	Asn	Ile	Ser	Gln	Asp	Val	Phe	Asn	Cys	Phe	Lys
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Gly	Met	Leu	Gln	Leu	Tyr	Glu	Ala	Ser	Phe	Leu	Leu	Arg	Lys	Gly	Glu
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Phe	Phe	Trp	Ala	Val	Gly	Met	Phe	Glu	Pro	His	Gln	His	Gly	Tyr	Gln
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Lys	Ser	Val	Val	Asp	Leu	Val	Glu	Ala	Tyr	Phe	His	Glu	Ala	Lys	Trp
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Phe	Ala	Asn	Ala	Ser	His	Asp	Thr	Ala	Val	Ile	Asp	Ser	Leu	Tyr	Gln
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Thr	Ile	Gln	Cys	Tyr	Met	Lys	Glu	Thr	Asn	Ala	Ser	Glu	Glu	Glu	Ala
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Val	Glu	His	Val	Lys	Phe	Leu	Ile	Arg	Glu	Ala	Trp	Lys	Asp	Met	Asn
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Thr	Ala	Ile	Ala	Ala	Gly	Tyr	Pro	Phe	Pro	Asp	Gly	Met	Val	Ala	Gly
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Ala	Ala	Asn	Ile	Gly	Arg	Val	Ala	Gln	Phe	Ile	Tyr	Leu	His	Gly	Asp
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Gly	Phe	Gly	Val	Gln	His	Ser	Lys	Thr	Tyr	Glu	His	Ile	Ala	Gly	Leu
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<221> CDS

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Arg	Phe	Arg	Leu	Leu	Arg	Gln	His	Gln	Arg	His	Val	Ser	Cys	Asp	Val	
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Phe	Asp	Lys	Phe	Ile	Asp	Lys	Asp	Gly	Lys	Phe	Glu	Glu	Ser	Leu	Ser	
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Asn	Asn	Val	Glu	Gly	Leu	Leu	Ser	Leu	Tyr	Glu	Ala	Ala	His	Val	Gly	
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cac	ttg	gaa	gga	gca	gag	tta	gat	cag	tct	cca	tta	ttg	att	aga	gag	637
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Lys	Val	Lys	Arg	Ala	Leu	Glu	His	Pro	Leu	His	Arg	Asp	Phe	Pro	Ile	
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Asp	Glu	Leu	Leu	Leu	Lys	Leu	Ser	Lys	Val	Asn	Phe	Lys	Phe	Met	Gln	
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Asn	Leu	Tyr	Lys	Glu	Glu	Leu	Ser	Gln	Leu	Ser	Arg	Trp	Trp	Asn	Thr	
		240					245					250				
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Trp	Asn	Leu	Lys	Ser	Lys	Leu	Pro	Tyr	Ala	Arg	Asp	Arg	Val	Val	Glu	
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gtt	cga	atgt	gga	ctt	gcc	aaa	ggc	gta	cta	att	tgt	gga	atc	atgt	gac	973
Val	Arg	Met	Gly	Leu	Ala	Lys	Gly	Val	Leu	Ile	Cys	Gly	Ile	Met	Asp	
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gat	aca	tat	gat	aat	tat	gct	aca	ctc	aat	gaa	gct	caa	ctt	ttt	act	1021
Asp	Thr	Tyr	Asp	Asn	Tyr	Ala	Thr	Leu	Asn	Glu	Ala	Gln	Leu	Phe	Thr	
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caa	gtc	tta	gac	aag	tggt	gat	aga	gat	gaa	gct	gaa	cga	ctc	cca	gaa	1069
Gln	Val	Leu	Asp	Lys	Trp	Asp	Arg	Asp	Glu	Ala	Glu	Arg	Leu	Pro	Glu	
		320					325					330				
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Tyr	Met	Lys	Ile	Val	Tyr	Arg	Phe	Ile	Leu	Ser	Ile	Tyr	Glu	Asn	Tyr	
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gaa	cgt	gat	gca	gcgt	aaa	ctt	gga	aaa	agc	ttt	gca	gct	cct	tat	ttt	1165
Glu	Arg	Asp	Ala	Ala	Lys	Leu	Gly	Lys	Ser	Phe	Ala	Ala	Pro	Tyr	Phe	
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Lys	Glu	Thr	Val	Lys	Gln	Leu	Ala	Arg	Ala	Phe	Asn	Glu	Glu	Gln	Lys	
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Trp	Val	Met	Glu	Arg	Gln	Leu	Pro	Ser	Phe	Gln	Asp	Tyr	Val	Lys	Asn	
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Ser	Glu	Lys	Thr	Ser	Cys	Ile	Tyr	Thr	Met	Phe	Ala	Ser	Ile	Ile	Pro	
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acc agc tct cag ctc cgt gaa agc aaa gga ggg gaa atg ctg act gcg Thr Ser Ser Gln Leu Arg Glu Ser Lys Gly Gly Glu Met Leu Thr Ala 450 455 460			1453
ttg gat ttc cac atg aaa gaa tat ggt ctg acg aag gaa gag gcg gca Leu Asp Phe His Met Lys Glu Tyr Gly Leu Thr Lys Glu Glu Ala Ala 465 470 475			1501
tct aag ttt gaa gga ttg gtt gag gaa aca tgg aag gat ata aac aag Ser Lys Phe Glu Gly Leu Val Glu Glu Thr Trp Lys Asp Ile Asn Lys 480 485 490			1549
gaa ttc ata gcc aca act aat tat aat gtg ggt aga gaa att gcc atc Glu Phe Ile Ala Thr Thr Asn Tyr Asn Val Gly Arg Glu Ile Ala Ile 495 500 505			1597
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gac gga gac gct tat tca gat cct aat gtt gcc aag gca aat gtc gtt Asp Gly Asp Ala Tyr Ser Asp Pro Asn Val Ala Lys Ala Asn Val Val 530 535 540			1693
gct ctc ttt gtt gat gcc ata gtc ttt tga tttgcataat caaagaccct Ala Leu Phe Val Asp Ala Ile Val Phe * 545 550			1743
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Phe	Ser	Leu	Asp	Asp	Lys	Glu	Gln	Gln	Lys	Cys	Ser	Glu	Thr	Ile	Glu
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Leu	Gln	Gln	Met	Thr	Leu	Ile	Asp	Thr	Leu	Glu	Arg	Leu	Gly	Leu	Ser
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Phe	His	Phe	Glu	Thr	Glu	Ile	Glu	Tyr	Lys	Ile	Glu	Leu	Ile	Asn	Ala
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Ala	Glu	Asp	Asp	Gly	Phe	Asp	Leu	Phe	Ala	Thr	Ala	Leu	Arg	Phe	Arg
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Glu	Gly	Leu	Leu	Ser	Leu	Tyr	Glu	Ala	Ala	His	Val	Gly	Phe	Arg	Glu
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Glu	Arg	Ile	Leu	Gln	Glu	Ala	Val	Asn	Phe	Thr	Arg	His	His	Leu	Glu
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Gly	Ala	Glu	Leu	Asp	Gln	Ser	Pro	Leu	Leu	Ile	Arg	Glu	Lys	Val	Lys
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Lys	Glu	Glu	Leu	Ser	Gln	Leu	Ser	Arg	Trp	Trp	Asn	Thr	Trp	Asn	Leu
				245					250					255	
Lys	Ser	Lys	Leu	Pro	Tyr	Ala	Arg	Asp	Arg	Val	Val	Glu	Ala	Tyr	Val
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Trp	Gly	Val	Gly	Tyr	His	Tyr	Glu	Pro	Gln	Tyr	Ser	Tyr	Val	Arg	Met
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Thr	Ser	Cys	Ile	Tyr	Thr	Met	Phe	Ala	Ser	Ile	Ile	Pro	Gly	Leu	Lys
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Gln	Leu	Arg	Glu	Ser	Lys	Gly	Gly	Glu	Met	Leu	Thr	Ala	Leu	Asp	Phe
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Glu	Gly	Leu	Val	Glu	Glu	Thr	Trp	Lys	Asp	Ile	Asn	Lys	Glu	Phe	Ile

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	Met Ala Leu Val Ser Ile	Ser Pro Leu Ala Ser Lys	Ser Cys													
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ctg cgc aag tcg ttg atc agt tca att cat gaa cat aag cct ccc tat																158
Leu Arg Lys Ser Leu Ile Ser Ser Ile His Glu His Lys Pro Pro Tyr																
15				20				25						30		
aga aca atc cca aat ctt gga atg cgt agg cga ggg aaa tct gtc acg																206
Arg Thr Ile Pro Asn Leu Gly Met Arg Arg Arg Gly Lys Ser Val Thr																
			35				40						45			
cct tcc atg agc atc agt ttg gcc acc gct gca cct gat gat ggt gta																254
Pro Ser Met Ser Ile Ser Leu Ala Thr Ala Ala Pro Asp Asp Gly Val																
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caa aga cgc ata ggt gac tac cat tcc aat atc tgg gac gat gat ttc																302
Gln Arg Arg Ile Gly Asp Tyr His Ser Asn Ile Trp Asp Asp Asp Phe																
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ata cag tct cta tca acg cct tat ggg gaa ccc tct tac cag gaa cgt																350
Ile Gln Ser Leu Ser Thr Pro Tyr Gly Glu Pro Ser Tyr Gln Glu Arg																
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gct gag aga tta att gtg gag gta aag aag ata ttc aat tca atg tac																398
Ala Glu Arg Leu Ile Val Glu Val Lys Lys Ile Phe Asn Ser Met Tyr																
			95				100				105			110		
ctg gat gat gga aga tta atg agt tcc ttt aat gat ctc atg caa cgc																446
Leu Asp Asp Gly Arg Leu Met Ser Ser Phe Asn Asp Leu Met Gln Arg																
			115								120			125		

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Leu	Trp	Ile	Val	Asp	Ser	Val	Glu	Arg	Leu	Gly	Ile	Ala	Arg	His	Phe	
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aag	aac	gag	ata	aca	tca	gct	ctg	gat	tat	gtt	ttc	cgt	tac	tg	gag	542
Lys	Asn	Glu	Ile	Thr	Ser	Ala	Leu	Asp	Tyr	Val	Phe	Arg	Tyr	Trp	Glu	
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Glu	Asn	Gly	Ile	Gly	Cys	Gly	Arg	Asp	Ser	Ile	Val	Thr	Asp	Leu	Asn	
	160					165					170					
tca	act	gcg	ttg	ggg	ttt	cga	act	ctt	cga	tta	cac	ggg	tac	act	gta	638
Ser	Thr	Ala	Leu	Gly	Phe	Arg	Thr	Leu	Arg	Leu	His	Gly	Tyr	Thr	Val	
175					180					185					190	
tct	cca	gag	gtt	tta	aaa	gct	ttt	caa	gat	caa	aat	gga	cag	ttt	gta	686
Ser	Pro	Glu	Val	Leu	Lys	Ala	Phe	Gln	Asp	Gln	Asn	Gly	Gln	Phe	Val	
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tgc	tcc	ccc	gg	cag	aca	gag	gg	gag	atc	aga	agc	gtt	ctt	aac	tta	734
Cys	Ser	Pro	Gly	Gln	Thr	Glu	Gly	Glu	Ile	Arg	Ser	Val	Leu	Asn	Leu	
			210				215						220			
tat	cgg	gct	tcc	ctc	att	gcc	ttc	cct	gg	gag	aaa	gtt	atg	gaa	gaa	782
Tyr	Arg	Ala	Ser	Leu	Ile	Ala	Phe	Pro	Gly	Glu	Lys	Val	Met	Glu	Glu	
		225					230					235				
gct	gaa	atc	ttc	tcc	aca	aga	tat	ttg	aaa	gaa	gct	cta	caa	aag	att	830
Ala	Glu	Ile	Phe	Ser	Thr	Arg	Tyr	Leu	Lys	Glu	Ala	Leu	Gln	Lys	Ile	
	240					245					250					
cca	gtc	tcc	gct	ctt	tca	caa	gag	ata	aag	ttt	gtt	atg	gaa	tat	ggc	878
Pro	Val	Ser	Ala	Leu	Ser	Gln	Glu	Ile	Lys	Phe	Val	Met	Glu	Tyr	Gly	
255					260					265					270	
tg	cac	aca	aat	ttg	cca	aga	ttg	gaa	gca	aga	aat	tac	ata	gac	aca	926
Trp	His	Thr	Asn	Leu	Pro	Arg	Leu	Glu	Ala	Arg	Asn	Tyr	Ile	Asp	Thr	
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ctt	gag	aaa	gac	acc	agt	gca	tg	ctc	aat	aaa	aat	gct	ggg	aag	aag	974
Leu	Glu	Lys	Asp	Thr	Ser	Ala	Trp	Leu	Asn	Lys	Asn	Ala	Gly	Lys	Lys	
			290					295					300			
ctt	tta	gaa	ctt	gca	aaa	ttg	gag	ttc	aat	ata	ttt	aac	tcc	tta	caa	1022
Leu	Leu	Glu	Leu	Ala	Lys	Leu	Glu	Phe	Asn	Ile	Phe	Asn	Ser	Leu	Gln	
		305					310					315				
caa	aag	gaa	tta	caa	tat	ctt	ttg	aga	tg	tg	aaa	gag	tcg	gat	ttg	1070
Gln	Lys	Glu	Leu	Gln	Tyr	Leu	Leu	Arg	Trp	Trp	Lys	Glu	Ser	Asp	Leu	
	320					325					330					

cct	aaa	ttg	aca	ttt	gct	cgg	cat	cgt	cat	gtg	gaa	ttc	tac	act	ttg	1118
Pro	Lys	Leu	Thr	Phe	Ala	Arg	His	Arg	His	Val	Glu	Phe	Tyr	Thr	Leu	
335					340					345					350	
gcc	tct	tgt	att	gcc	att	gac	cca	aaa	cat	tct	gca	ttc	aga	cta	ggc	1166
Ala	Ser	Cys	Ile	Ala	Ile	Asp	Pro	Lys	His	Ser	Ala	Phe	Arg	Leu	Gly	
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ttc	gcc	aaa	atg	tgt	cat	ctt	gtc	aca	gtt	ttg	gac	gat	att	tac	gac	1214
Phe	Ala	Lys	Met	Cys	His	Leu	Val	Thr	Val	Leu	Asp	Asp	Ile	Tyr	Asp	
			370					375					380			
act	ttt	gga	acg	att	gac	gag	ctt	gaa	ctc	ttc	aca	tct	gca	att	aag	1262
Thr	Phe	Gly	Thr	Ile	Asp	Glu	Leu	Glu	Leu	Phe	Thr	Ser	Ala	Ile	Lys	
		385					390					395				
aga	tgg	aat	tca	tca	gag	ata	gaa	cac	ctt	cca	gaa	tat	atg	aaa	tgt	1310
Arg	Trp	Asn	Ser	Ser	Glu	Ile	Glu	His	Leu	Pro	Glu	Tyr	Met	Lys	Cys	
	400					405					410					
gtg	tac	atg	gtc	gtg	ttt	gaa	act	gta	aat	gaa	ctg	aca	cga	gag	gcg	1358
Val	Tyr	Met	Val	Val	Phe	Glu	Thr	Val	Asn	Glu	Leu	Thr	Arg	Glu	Ala	
415					420					425					430	
gag	aag	act	caa	ggg	aga	aac	act	ctc	aac	tat	gtt	cga	aag	gct	tgg	1406
Glu	Lys	Thr	Gln	Gly	Arg	Asn	Thr	Leu	Asn	Tyr	Val	Arg	Lys	Ala	Trp	
			435						440					445		
gag	gct	tat	ttt	gat	tca	tat	atg	gaa	gaa	gca	aaa	tgg	atc	tct	aat	1454
Glu	Ala	Tyr	Phe	Asp	Ser	Tyr	Met	Glu	Glu	Ala	Lys	Trp	Ile	Ser	Asn	
			450					455					460			
ggt	tat	ctg	cca	atg	ttt	gaa	gag	tac	cat	gag	aat	ggg	aaa	gtg	agc	1502
Gly	Tyr	Leu	Pro	Met	Phe	Glu	Glu	Tyr	His	Glu	Asn	Gly	Lys	Val	Ser	
		465				470						475				
tct	gca	tat	cgc	gta	gca	aca	ttg	caa	ccc	atc	ctc	act	ttg	aat	gca	1550
Ser	Ala	Tyr	Arg	Val	Ala	Thr	Leu	Gln	Pro	Ile	Leu	Thr	Leu	Asn	Ala	
	480					485					490					
tgg	ctt	cct	gat	tac	atc	ttg	aag	gga	att	gat	ttt	cca	tcc	agg	ttc	1598
Trp	Leu	Pro	Asp	Tyr	Ile	Leu	Lys	Gly	Ile	Asp	Phe	Pro	Ser	Arg	Phe	
495					500					505					510	
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Asn	Asp	Leu	Ala	Ser	Ser	Phe	Leu	Arg	Leu	Arg	Gly	Asp	Thr	Arg	Cys	
				515					520					525		
tac	aag	gcc	gat	agg	gat	cgt	ggt	gaa	gaa	gct	tcg	tgt	ata	tca	tgt	1694
Tyr	Lys	Ala	Asp	Arg	Asp	Arg	Gly	Glu	Glu	Ala	Ser	Cys	Ile	Ser	Cys	
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Tyr	Met	Lys	Asp	Asn	Pro	Gly	Ser	Thr	Glu	Glu	Asp	Ala	Leu	Asn	His		
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atc	aat	gcc	atg	gtc	aat	gac	ata	atc	aaa	gaa	tta	aat	tgg	gaa	ctt	1790	
Ile	Asn	Ala	Met	Val	Asn	Asp	Ile	Ile	Lys	Glu	Leu	Asn	Trp	Glu	Leu		
	560					565					570						
cta	aga	tcc	aac	gac	aat	att	cca	atg	ctg	gcc	aag	aaa	cat	gct	ttt	1838	
Leu	Arg	Ser	Asn	Asp	Asn	Ile	Pro	Met	Leu	Ala	Lys	Lys	His	Ala	Phe		
	575				580					585					590		
gac	ata	aca	aga	gct	ctc	cac	cat	ctc	tac	ata	tat	cga	gat	ggc	ttt	1886	
Asp	Ile	Thr	Arg	Ala	Leu	His	His	Leu	Tyr	Ile	Tyr	Arg	Asp	Gly	Phe		
				595					600					605			
agt	gtt	gcc	aac	aag	gaa	aca	aaa	aaa	ttg	gtt	atg	gaa	aca	ctc	ctt	1934	
Ser	Val	Ala	Asn	Lys	Glu	Thr	Lys	Lys	Leu	Val	Met	Glu	Thr	Leu	Leu		
			610					615					620				
gaa	tct	atg	ctt	ttt	taa	ctataac	cat	atccata	ata	ataag	ctcat					1982	
Glu	Ser	Met	Leu	Phe	*												
			625														
aatgctaaat	tattggcctt	atgacatagt	ttatgtatgt	acttgtgtga	attcaatcat											2042	
atcgtgtggg	tatgattaaa	aagctagagc	ttactagggt	agtaacatgg	tgataaaagt											2102	
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			20					25					30				
Ile	Pro	Asn	Leu	Gly	Met	Arg	Arg	Arg	Gly	Lys	Ser	Val	Thr	Pro	Ser		
		35				40						45					
Met	Ser	Ile	Ser	Leu	Ala	Thr	Ala	Ala	Pro	Asp	Asp	Gly	Val	Gln	Arg		
	50					55				60							
Arg	Ile	Gly	Asp	Tyr	His	Ser	Asn	Ile	Trp	Asp	Asp	Asp	Phe	Ile	Gln		
	65				70					75				80			
Ser	Leu	Ser	Thr	Pro	Tyr	Gly	Glu	Pro	Ser	Tyr	Gln	Glu	Arg	Ala	Glu		
			85					90					95				
Arg	Leu	Ile	Val	Glu	Val	Lys	Lys	Ile	Phe	Asn	Ser	Met	Tyr	Leu	Asp		
			100					105					110				
Asp	Gly	Arg	Leu	Met	Ser	Ser	Phe	Asn	Asp	Leu	Met	Gln	Arg	Leu	Trp		
		115					120					125					
Ile	Val	Asp	Ser	Val	Glu	Arg	Leu	Gly	Ile	Ala	Arg	His	Phe	Lys	Asn		
	130					135					140						
Glu	Ile	Thr	Ser	Ala	Leu	Asp	Tyr	Val	Phe	Arg	Tyr	Trp	Glu	Glu	Asn		

145	Gly	Ile	Gly	Cys	Gly	Arg	Asp	Ser	Ile	Val	Thr	Asp	Leu	Asn	Ser	Thr
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	Ala	Leu	Gly	Phe	Arg	Thr	Leu	Arg	Leu	His	Gly	Tyr	Thr	Val	Ser	Pro
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	Ala	Ser	Leu	Ile	Ala	Phe	Pro	Gly	Glu	Lys	Val	Met	Glu	Glu	Ala	Glu
225					230						235					240
	Ile	Phe	Ser	Thr	Arg	Tyr	Leu	Lys	Glu	Ala	Leu	Gln	Lys	Ile	Pro	Val
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	Ser	Ala	Leu	Ser	Gln	Glu	Ile	Lys	Phe	Val	Met	Glu	Tyr	Gly	Trp	His
			260						265					270		
	Thr	Asn	Leu	Pro	Arg	Leu	Glu	Ala	Arg	Asn	Tyr	Ile	Asp	Thr	Leu	Glu
		275					280						285			
	Lys	Asp	Thr	Ser	Ala	Trp	Leu	Asn	Lys	Asn	Ala	Gly	Lys	Lys	Leu	Leu
		290				295						300				
	Glu	Leu	Ala	Lys	Leu	Glu	Phe	Asn	Ile	Phe	Asn	Ser	Leu	Gln	Gln	Lys
305					310						315					320
	Glu	Leu	Gln	Tyr	Leu	Leu	Arg	Trp	Trp	Lys	Glu	Ser	Asp	Leu	Pro	Lys
				325						330					335	
	Leu	Thr	Phe	Ala	Arg	His	Arg	His	Val	Glu	Phe	Tyr	Thr	Leu	Ala	Ser
			340						345					350		
	Cys	Ile	Ala	Ile	Asp	Pro	Lys	His	Ser	Ala	Phe	Arg	Leu	Gly	Phe	Ala
		355					360						365			
	Lys	Met	Cys	His	Leu	Val	Thr	Val	Leu	Asp	Asp	Ile	Tyr	Asp	Thr	Phe
		370				375						380				
	Gly	Thr	Ile	Asp	Glu	Leu	Glu	Leu	Phe	Thr	Ser	Ala	Ile	Lys	Arg	Trp
385					390						395					400
	Asn	Ser	Ser	Glu	Ile	Glu	His	Leu	Pro	Glu	Tyr	Met	Lys	Cys	Val	Tyr
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	Met	Val	Val	Phe	Glu	Thr	Val	Asn	Glu	Leu	Thr	Arg	Glu	Ala	Glu	Lys
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	Thr	Gln	Gly	Arg	Asn	Thr	Leu	Asn	Tyr	Val	Arg	Lys	Ala	Trp	Glu	Ala
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	Tyr	Phe	Asp	Ser	Tyr	Met	Glu	Glu	Ala	Lys	Trp	Ile	Ser	Asn	Gly	Tyr
		450				455						460				
	Leu	Pro	Met	Phe	Glu	Glu	Tyr	His	Glu	Asn	Gly	Lys	Val	Ser	Ser	Ala
465					470						475					480
	Tyr	Arg	Val	Ala	Thr	Leu	Gln	Pro	Ile	Leu	Thr	Leu	Asn	Ala	Trp	Leu
				485					490						495	
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			500						505					510		
	Leu	Ala	Ser	Ser	Phe	Leu	Arg	Leu	Arg	Gly	Asp	Thr	Arg	Cys	Tyr	Lys
		515						520					525			
	Ala	Asp	Arg	Asp	Arg	Gly	Glu	Glu	Ala	Ser	Cys	Ile	Ser	Cys	Tyr	Met
		530				535						540				
	Lys	Asp	Asn	Pro	Gly	Ser	Thr	Glu	Glu	Asp	Ala	Leu	Asn	His	Ile	Asn
545					550						555					560
	Ala	Met	Val	Asn	Asp	Ile	Ile	Lys	Glu	Leu	Asn	Trp	Glu	Leu	Leu	Arg
				565						570					575	

Ser	Asn	Asp	Asn	Ile	Pro	Met	Leu	Ala	Lys	Lys	His	Ala	Phe	Asp	Ile
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Thr	Arg	Ala	Leu	His	His	Leu	Tyr	Ile	Tyr	Arg	Asp	Gly	Phe	Ser	Val
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Ala	Asn	Lys	Glu	Thr	Lys	Lys	Leu	Val	Met	Glu	Thr	Leu	Leu	Glu	Ser
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Thr	Pro	Ala	Ala	Val	Val	Met	Ser	Asn	Tyr	Gly	Glu	Glu	Glu	Ile	Val	
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cgc	ccc	ata	gct	gac	ttc	tct	cca	agt	ctt	tgg	ggg	gat	cgt	ttt	cat	155
Arg	Pro	Ile	Ala	Asp	Phe	Ser	Pro	Ser	Leu	Trp	Gly	Asp	Arg	Phe	His	
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Ser	Phe	Ser	Leu	Asp	Asn	Gln	Ile	Ala	Gly	Lys	Tyr	Ala	Gln	Glu	Ile	
	35					40					45					
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Glu	Thr	Leu	Lys	Glu	Gln	Ser	Arg	Ile	Ile	Leu	Ser	Ala	Ser	Ser	Arg	
	50				55					60					65	
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Arg	Thr	Leu	Ala	Glu	Lys	Leu	Asp	Leu	Ile	Asp	Ile	Val	Glu	Arg	Leu	
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ggc	att	gct	tat	cat	ttt	gaa	aaa	caa	ata	gat	gat	atg	ttg	gat	caa	347
Gly	Ile	Ala	Tyr	His	Phe	Glu	Lys	Gln	Ile	Asp	Asp	Met	Leu	Asp	Gln	
			85					90					95			
ttt	tac	aaa	gca	gat	cct	aac	ttt	gag	gct	cac	gag	tac	aat	gat	tta	395
Phe	Tyr	Lys	Ala	Asp	Pro	Asn	Phe	Glu	Ala	His	Glu	Tyr	Asn	Asp	Leu	
		100					105					110				
caa	act	tta	tcc	gtt	caa	ttt	cga	cta	ttg	aga	caa	cat	ggg	tac	aat	443

Gln	Thr	Leu	Ser	Val	Gln	Phe	Arg	Leu	Leu	Arg	Gln	His	Gly	Tyr	Asn		
115						120					125						
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Ile	Ser	Pro	Lys	Leu	Phe	Ile	Arg	Phe	Gln	Asp	Ala	Lys	Gly	Lys	Phe		
130					135					140					145		
aaa	gaa	tct	ctt	tgt	aac	gac	atc	aag	ggt	ctt	ttg	aac	tta	tac	gaa	539	
Lys	Glu	Ser	Leu	Cys	Asn	Asp	Ile	Lys	Gly	Leu	Leu	Asn	Leu	Tyr	Glu		
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gcc	tcg	cat	gta	agg	act	cat	gga	gaa	gat	att	ttg	gaa	gag	gca	ctt	587	
Ala	Ser	His	Val	Arg	Thr	His	Gly	Glu	Asp	Ile	Leu	Glu	Glu	Ala	Leu		
			165					170						175			
gct	ttc	tct	act	gct	cat	ctt	gaa	tct	gca	gct	cca	cat	ttg	aag	tca	635	
Ala	Phe	Ser	Thr	Ala	His	Leu	Glu	Ser	Ala	Ala	Pro	His	Leu	Lys	Ser		
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cct	ctg	agt	aag	caa	gtg	aca	cat	gcc	ctt	gag	caa	tct	ctc	cat	aag	683	
Pro	Leu	Ser	Lys	Gln	Val	Thr	His	Ala	Leu	Glu	Gln	Ser	Leu	His	Lys		
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agc	att	cca	aga	gtt	gag	aca	cgc	tac	ttc	atc	tct	atc	tac	gaa	gag	731	
Ser	Ile	Pro	Arg	Val	Glu	Thr	Arg	Tyr	Phe	Ile	Ser	Ile	Tyr	Glu	Glu		
210				215						220					225		
gag	gaa	cag	aag	aat	gat	gtg	ttg	ctt	caa	ttt	gca	aaa	ctg	gac	ttc	779	
Glu	Glu	Gln	Lys	Asn	Asp	Val	Leu	Leu	Gln	Phe	Ala	Lys	Leu	Asp	Phe		
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aac	tta	ctt	cag	atg	ttg	cac	aaa	caa	gaa	ctt	agt	gaa	gta	tca	agg	827	
Asn	Leu	Leu	Gln	Met	Leu	His	Lys	Gln	Glu	Leu	Ser	Glu	Val	Ser	Arg		
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Trp	Trp	Lys	Asp	Leu	Asp	Phe	Val	Thr	Thr	Leu	Pro	Tyr	Ala	Arg	Asp		
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aga	gca	gtg	gaa	tgc	tac	ttt	tgg	acg	atg	ggg	gtg	tat	gct	gaa	cct	923	
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Gln	Tyr	Ser	Gln	Ala	Arg	Val	Met	Leu	Ala	Lys	Thr	Ile	Ala	Met	Ile		
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tct	ata	gta	gat	gac	aca	ttc	gat	gct	tat	ggc	att	gtc	aaa	gaa	ctt	1019	
Ser	Ile	Val	Asp	Asp	Thr	Phe	Asp	Ala	Tyr	Gly	Ile	Val	Lys	Glu	Leu		
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Glu	Ile	Tyr	Thr	Asp	Ala	Ile	Gln	Arg	Trp	Asp	Ile	Ser	Gln	Ile	Asp		

325						330						335						
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Arg	Leu	Pro	Asp	Tyr	Met	Lys	Ile	Ser	Tyr	Lys	Ala	Leu	Leu	Asp	Leu			
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Tyr	Asn	Asp	Tyr	Glu	Met	Glu	Leu	Ser	Lys	Asp	Gly	Arg	Ser	Asp	Val			
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Val	His	Tyr	Ala	Lys	Glu	Arg	Met	Lys	Glu	Ile	Val	Arg	Asn	Tyr	Phe			
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Thr	Ser	Tyr	Leu	Gly	Met	Lys	Ser	Ala	Asn	Lys	Gln	Asp	Phe	Glu	Trp			
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Leu	Thr	Arg	Ile	Leu	Asn	Leu	Ala	Arg	Ile	Ile	Asp	Val	Thr	Tyr	Lys			
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1737

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 1857
 1917
 1944

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 Leu Gly Ile Ala Tyr His Phe Glu Lys Gln Ile Asp Asp Met Leu Asp
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 Gln Phe Tyr Lys Ala Asp Pro Asn Phe Glu Ala His Glu Tyr Asn Asp
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 Asn Ile Ser Pro Lys Leu Phe Ile Arg Phe Gln Asp Ala Lys Gly Lys
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 Phe Lys Glu Ser Leu Cys Asn Asp Ile Lys Gly Leu Leu Asn Leu Tyr
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 Glu Ala Ser His Val Arg Thr His Gly Glu Asp Ile Leu Glu Glu Ala
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 Leu Ala Phe Ser Thr Ala His Leu Glu Ser Ala Ala Pro His Leu Lys
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 Ser Pro Leu Ser Lys Gln Val Thr His Ala Leu Glu Gln Ser Leu His
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 Lys Ser Ile Pro Arg Val Glu Thr Arg Tyr Phe Ile Ser Ile Tyr Glu
 210 215 220
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 Phe Asn Leu Leu Gln Met Leu His Lys Gln Glu Leu Ser Glu Val Ser
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 Asp Arg Ala Val Glu Cys Tyr Phe Trp Thr Met Gly Val Tyr Ala Glu
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 Pro Gln Tyr Ser Gln Ala Arg Val Met Leu Ala Lys Thr Ile Ala Met

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	Leu	Tyr	Asn	Asp	Tyr	Glu	Met	Glu	Leu	Ser	Lys	Asp	Gly	Arg	Ser	Asp
	Val	Val	His	Tyr	Ala	Lys	Glu	Arg	Met	Lys	Glu	Ile	Val	Arg	Asn	Tyr
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	Arg	Val	Ile	Asp	Asp	Ile	Ala	Thr	Tyr	Glu	Val	Glu	Lys	Gly	Arg	Gly
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	Lys	Asp	Val	Asn	Glu	Gly	Ile	Leu	Arg	Pro	Thr	Pro	Val	Ser	Thr	Glu
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	Lys	His	Asn	Gln	Asp	Gly	Tyr	Thr	His	Pro	Glu	Lys	Val	Leu	Lys	Pro
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cggagtataa	tatttttatgt	agtagttatt	ctttttactat	ataaataaat	aaataaaatt	840
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His	Pro	Ala	Ile	Ser	Ser	Glu	Asn	Arg	Pro	Lys	Ala	Asp	Phe	His	Pro	
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Gly	Ile	Trp	Gly	Asp	Met	Phe	Ile	Ile	Cys	Pro	Asp	Thr			
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Ser Asn Gln Lys Leu Pro Phe Ile Asp Ala Val Gln Arg Leu Gly Val	
70 75 80	
agt tat cat ttt gag aaa gag att gaa gat gaa cta gag aat att tac	1846
Ser Tyr His Phe Glu Lys Glu Ile Glu Asp Glu Leu Glu Asn Ile Tyr	
85 90 95 100	
cgt gac acc aac aac aat gat gcg gac acc gat ctc tac act aca gcc	1894
Arg Asp Thr Asn Asn Asn Asp Ala Asp Thr Asp Leu Tyr Thr Thr Ala	
105 110 115	
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Leu Arg Phe Arg Leu Leu Arg Glu His Gly Phe Asp Ile Ser Cys	
120 125 130	
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actttacatt aataatcatc tgtacaatac ttcaatatat atatatttat tgatgaaact	2059
aatgtttgat gatgattttg ggtgcttgac ca gat gca ttc aac aag ttc aaa	2112
Asp Ala Phe Asn Lys Phe Lys	
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gat gag gca ggg aac ttc aag gca tca ttg aca agt gat gtg caa ggg	2160
Asp Glu Ala Gly Asn Phe Lys Ala Ser Leu Thr Ser Asp Val Gln Gly	
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Leu Leu Glu Leu Tyr Glu Ala Ser Tyr Met Arg Val His Gly Glu Asp	
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ata ctt gat gaa gcc att tct ttc acc act gct caa ctt aca ctt gct	2256
Ile Leu Asp Glu Ala Ile Ser Phe Thr Thr Ala Gln Leu Thr Leu Ala	
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Leu Pro Thr Leu His His Pro Leu Ser Glu Gln Val Gly His Ala Leu	
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Lys Gln Ser Ile Arg Arg Gly Leu Pro Arg Val Glu Ala Arg Asn Phe	
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220 225 230	
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Phe Ala Lys Ile Asp Phe Asn Leu Leu Gln Leu Leu His Arg Lys Glu	

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Leu Ser Glu Ile Cys Arg				
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gg tgg tgg aaa gat tta gac ttt aca aga aaa cta cca ttt gca aga				2603
Trp Trp Lys Asp Leu Asp Phe Thr Arg Lys Leu Pro Phe Ala Arg				
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gat aga gtg gtt gaa ggc tat ttt tgg ata atg gga gtt tac ttt gaa				2651
Asp Arg Val Val Glu Gly Tyr Phe Trp Ile Met Gly Val Tyr Phe Glu				
275	280	285		
ccc caa tac tct ctt ggt aga aag atg ttg aca aaa gtc ata gca atg				2699
Pro Gln Tyr Ser Leu Gly Arg Lys Met Leu Thr Lys Val Ile Ala Met				
290	295	300		
gct tcc att gtt gat gat act tat gat tca tat gca acc tat gat gaa				2747
Ala Ser Ile Val Asp Asp Thr Tyr Asp Ser Tyr Ala Thr Tyr Asp Glu				
305	310	315		
ctc att ccc tat aca aat gca att gaa ggtgagattt tttttccttt				2794
Leu Ile Pro Tyr Thr Asn Ala Ile Glu				
320	325			
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			330	
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Ile Lys Cys Met Asn Gln Leu Pro Asn Tyr Met Lys Ile Ser Tyr Lys				
335	340	345		
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Ala Leu Leu Asp Val Tyr Glu Glu Met Glu Gln Leu Leu Ala Asn Gln				
350	355	360		
ggg aga cag tac cga gtt gag tat gcg aaa aag gcg gtatgtaatg				3113
Gly Arg Gln Tyr Arg Val Glu Tyr Ala Lys Lys Ala				
365	370	375		
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tttgcttact tttttatgcc tttaatcctc ag atg ata cgt ctt gtt caa gct				3226
	Met Ile Arg Leu Val Gln Ala			
	380			
tac ctt ttg gag gcc aaa tgg act cat caa aat tat aaa cca acc ttt				3274
Tyr Leu Leu Glu Ala Lys Trp Thr His Gln Asn Tyr Lys Pro Thr Phe				
385	390	395		

gag gaa ttt aga gat aat gca ttg cca acc tct ggc tat gcc atg ctt Glu Glu Phe Arg Asp Asn Ala Leu Pro Thr Ser Gly Tyr Ala Met Leu 400 405 410	3322
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 Asp Met Phe Ile Ile Cys Pro Asp Thr
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 35 40 45
 Lys Glu Ile Glu Asp Glu Leu Glu Asn Ile Tyr Arg Asp Thr Asn Asn
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 Thr Ala Gln Leu Thr Leu Ala Leu Pro Thr Leu His His Pro Leu Ser
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 Glu Gln Val Gly His Ala Leu Lys Gln Ser Ile Arg Arg Gly Leu Pro
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 Arg Val Glu Ala Arg Asn Phe Ile Ser Ile Tyr Gln Asp Leu Glu Ser
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			20					25					30		
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<213> Gossypium arboreum

<400> 39

Met	Ile	Arg	Leu	Val	Gln	Ala	Tyr	Leu	Leu	Glu	Ala	Lys	Trp	Thr	His
1				5					10					15	
Gln	Asn	Tyr	Lys	Pro	Thr	Phe	Glu	Glu	Phe	Arg	Asp	Asn	Ala	Leu	Pro
			20					25					30		
Thr	Ser	Gly	Tyr	Ala	Met	Leu	Ala	Ile	Thr	Ala	Phe	Val	Gly	Met	Gly
		35					40					45			
Glu	Val	Ile	Thr	Pro	Glu	Thr	Phe	Lys	Trp	Ala	Ala	Ser	Asp	Pro	Lys
	50					55					60				
Ile	Ile	Lys	Ala	Ser	Thr	Ile	Ile	Cys	Arg	Phe	Met	Asp	Asp	Ile	Ala
65					70					75					80
Glu	His	Lys													

<210> 40

<211> 97

<212> PRT

<213> Gossypium arboreum

<400> 40

Phe	Asn	His	Arg	Arg	Glu	Asp	Asp	Cys	Ser	Ala	Ile	Glu	Cys	Tyr	Met	
1				5					10					15		
Lys	Gln	Tyr	Gly	Val	Thr	Ala	Gln	Glu	Ala	Tyr	Asn	Glu	Phe	Asn	Lys	
			20					25					30			
His	Ile	Glu	Ser	Ser	Trp	Lys	Asp	Val	Asn	Glu	Glu	Phe	Leu	Lys	Pro	
		35					40					45				
Thr	Glu	Met	Pro	Thr	Pro	Val	Leu	Cys	Arg	Ser	Leu	Asn	Leu	Ala	Arg	
	50					55					60					
Val	Met	Asp	Val	Leu	Tyr	Arg	Glu	Gly	Asp	Gly	Tyr	Thr	His	Val	Gly	
65					70					75					80	
Lys	Ala	Ala	Lys	Gly	Gly	Ile	Thr	Ser	Leu	Leu	Ile	Asp	Pro	Ile	Gln	
			85						90					95		
Ile																

<210> 41
 <211> 1994
 <212> DNA
 <213> Ricinus communis

<220>
 <221> CDS
 <222> (67)...(1869)
 <223> casbene synthase

<400> 41

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tgaaac	atg gca	ttg cca	tca gct	gct atg	caa tcc	aac cct	gaa aag
	Met	Ala	Leu	Pro	Ser	Ala	Ala Met
	1		5			10	
ctt aac	tta ttt	cac aga	ttg tca	agc tta	ccc acc	act agc	ttg gaa
Leu Asn	Leu Phe	His Arg	Leu Ser	Ser Ser	Leu Pro	Thr Thr	Ser Leu
	15		20		25		30
tat ggc	aat aat	cgc ttc	cct ttc	ttt tcc	tca tct	gcc aag	tca cac
Tyr Gly	Asn Asn	Arg Phe	Pro Phe	Phe Ser	Ser Ser	Ala Lys	Ser His
		35		40		45	
ttt aaa	aaa cca	act caa	gca tgt	tta tcc	tca aca	acc cac	caa gaa
Phe Lys	Lys Pro	Thr Gln	Ala Cys	Leu Ser	Ser Ser	Thr Thr	His Gln
	50		55			60	
gtt cgt	cca tta	gca tac	ttt cct	cct act	gtc tgg	ggc aat	cgc ttt
Val Arg	Pro Leu	Ala Tyr	Phe Pro	Pro Thr	Val Trp	Gly Asn	Arg Phe
	65		70			75	
gct tcc	ttg acc	ttc aat	cca tcg	gaa ttt	gaa tcg	tat gat	gaa cgg
Ala Ser	Leu Thr	Phe Asn	Pro Ser	Glu Phe	Glu Ser	Tyr Asp	Glu Arg
	80		85		90		
gta att	gtg ctg	aag aaa	aaa gtt	aag gac	ata tta	att tca	tct aca
Val Ile	Val Leu	Lys Lys	Lys Val	Lys Asp	Ile Leu	Ile Ser	Ser Thr

95	100					105					110					
agt gat tca gtg gag acc gtt att tta atc gac tta tta tgt cgg ctt Ser Asp Ser Val Glu Thr Val Ile Leu Ile Asp Leu Leu Cys Arg Leu	115					120					125					444
ggc gta tca tat cac ttt gaa aat gat att gaa gag cta cta agt aaa Gly Val Ser Tyr His Phe Glu Asn Asp Ile Glu Glu Leu Leu Ser Lys	130					135					140					492
atc ttc aac tcc cag cct gac ctt gtc gat gaa aaa gaa tgt gat ctc Ile Phe Asn Ser Gln Pro Asp Leu Val Asp Glu Lys Glu Cys Asp Leu	145					150					155					540
tac act gcg gca att gta ttc cga gtt ttc aga cag cat ggt ttt aaa Tyr Thr Ala Ala Ile Val Phe Arg Val Phe Arg Gln His Gly Phe Lys	160					165					170					588
atg tct tcg gat gtg ttt agc aaa ttc aag gac agt gat ggt aag ttc Met Ser Ser Asp Val Phe Ser Lys Phe Lys Asp Ser Asp Gly Lys Phe	175					180					185					636
aag gaa tcc cta cgg ggt gat gct aag ggt atg ctc agc ctt ttt gaa Lys Glu Ser Leu Arg Gly Asp Ala Lys Gly Met Leu Ser Leu Phe Glu	195					200					205					684
gct tcc cat cta agt gtg cat gga gaa gac att ctt gaa gaa gcc ttt Ala Ser His Leu Ser Val His Gly Glu Asp Ile Leu Glu Glu Ala Phe	210					215					220					732
gct ttc acc aag gat tac tta cag tcc tct gca gtt gag tta ttc cct Ala Phe Thr Lys Asp Tyr Leu Gln Ser Ser Ala Val Glu Leu Phe Pro	225					230					235					780
aat ctc aaa agg cat ata acg aac gcc cta gag cag cct ttc cac agt Asn Leu Lys Arg His Ile Thr Asn Ala Leu Glu Gln Pro Phe His Ser	240					245					250					828
ggc gtg ccg agg cta gag gcc agg aaa ttc atc gat cta tac gaa gct Gly Val Pro Arg Leu Glu Ala Arg Lys Phe Ile Asp Leu Tyr Glu Ala	255					260					265					876
gat att gaa tgc cgg aat gaa act ctg ctc gag ttt gca aag ttg gat Asp Ile Glu Cys Arg Asn Glu Thr Leu Leu Glu Phe Ala Lys Leu Asp	275					280					285					924
tat aat aga gtt cag tta ttg cac caa caa gag ctg tgc cag ttc tca Tyr Asn Arg Val Gln Leu Leu His Gln Gln Glu Leu Cys Gln Phe Ser	290					295					300					972
aag tgg tgg aaa gac ctg aat ctt gct tcg gat att cct tat gca aga Lys Trp Trp Lys Asp Leu Asn Leu Ala Ser Asp Ile Pro Tyr Ala Arg	305					310					315					1020

gac Asp 320	aga Arg	atg Met	gca Ala	gag Glu	att Ile	ttc Phe 325	ttt Phe	tgg Trp	gca Ala	gtc Val	gcg Ala 330	atg Met	tac Tyr	ttt Phe	gag Glu	1068
cct Pro 335	gac Asp	tat Tyr	gca Ala	cac His	acc Thr 340	cga Arg	atg Met	att Ile	att Ile	gcg Ala 345	aag Lys	gtt Val	gta Val	ttg Leu	ctt Leu 350	1116
ata Ile	tca Ser	cta Leu	ata Ile	gat Asp 355	gat Asp	aca Thr	att Ile	gat Asp	gcg Ala 360	tat Tyr	gca Ala	aca Thr	atg Met	gag Glu 365	gaa Glu	1164
act Thr	cat His	att Ile 370	ctt Leu	gct Ala	gaa Glu	gca Ala	gtc Val	gca Ala 375	agg Arg	tgg Trp	gac Asp	atg Met	agc Ser 380	tgc Cys	ctc Leu	1212
gag Glu	aag Lys	ctg Leu 385	cca Pro	gat Asp	tac Tyr	atg Met	aaa Lys 390	gtt Val	att Ile	tat Tyr	aaa Lys 395	cta Leu	ttg Leu	cta Leu	aac Asn	1260
acc Thr 400	ttc Phe	tct Ser	gaa Glu	ttc Phe	gag Glu	aaa Lys 405	gaa Glu	ttg Leu	acg Thr	gcg Ala	gaa Glu 410	ggc Gly	aag Lys	tcc Ser	tac Tyr	1308
agc Ser 415	gtc Val	aaa Lys	tac Tyr	gga Gly	agg Arg 420	gaa Glu	gcg Ala	ttt Phe	caa Gln	gaa Glu 425	cta Leu	gtg Val	aga Arg	ggc Gly	tac Tyr 430	1356
tac Tyr	ctg Leu	gag Glu	gct Ala	gta Val 435	tgg Trp	cgc Arg	gac Asp	gag Glu	ggc Gly 440	aaa Lys	ata Ile	cca Pro	tcg Ser	ttc Phe 445	gat Asp	1404
gac Asp	tac Tyr	ttg Leu	tat Tyr	aat Asn 450	gga Gly	tcc Ser	atg Met	acc Thr 455	acc Thr	gga Gly	ttg Leu	cct Pro	ctc Leu 460	gtc Val	tca Ser	1452
aca Thr	gct Ala	tct Ser 465	ttc Phe	atg Met	gga Gly	gtt Val	caa Gln 470	gaa Glu	att Ile	aca Thr	ggc Gly 475	ctc Leu	aac Asn	gaa Glu	ttc Phe	1500
caa Gln 480	tgg Trp	ctg Leu	gaa Glu	act Thr	aat Asn 485	ccc Pro	aaa Lys	tta Leu	agt Ser	tat Tyr	gct Ala 490	tcc Ser	ggc Gly	gca Ala	ttc Phe	1548
atc Ile 495	cga Arg	ctt Leu	gtc Val	aac Asn 500	gac Asp	tta Leu	act Thr	tct Ser	cat His	gtg Val 505	act Thr	gaa Glu	caa Gln	caa Gln	aga Arg 510	1596
gga Gly	cac His	gtt Val	gca Ala	tct Ser 515	tgc Cys	atc Ile	gac Asp	tgc Cys	tat Tyr 520	atg Met	aac Asn	caa Gln	cat His	gga Gly 525	gtt Val	1644

tcc	aaa	gac	gaa	gca	gtc	aaa	ata	ctt	caa	aaa	atg	gct	aca	gat	tgt	1692
Ser	Lys	Asp	Glu	Ala	Val	Lys	Ile	Leu	Gln	Lys	Met	Ala	Thr	Asp	Cys	
			530					535					540			
tgg	aaa	gaa	att	aat	gaa	gaa	tgt	atg	agg	cag	agt	caa	gtg	tca	gtg	1740
Trp	Lys	Glu	Ile	Asn	Glu	Glu	Cys	Met	Arg	Gln	Ser	Gln	Val	Ser	Val	
		545					550					555				
ggt	cac	cta	atg	aga	ata	gtt	aat	ctg	gca	cgt	ctt	acg	gat	gtg	agt	1788
Gly	His	Leu	Met	Arg	Ile	Val	Asn	Leu	Ala	Arg	Leu	Thr	Asp	Val	Ser	
		560				565					570					
tac	aag	tat	gga	gac	ggt	tac	act	gat	tcc	cag	caa	ttg	aaa	caa	ttt	1836
Tyr	Lys	Tyr	Gly	Asp	Gly	Tyr	Thr	Asp	Ser	Gln	Gln	Leu	Lys	Gln	Phe	
		575			580					585					590	
ggt	aag	gga	ttg	ttc	gtt	gat	cca	att	tct	att	tgaactcaat	aattcctttt				1889
Val	Lys	Gly	Leu	Phe	Val	Asp	Pro	Ile	Ser	Ile						
				595					600							
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tttaaattgc	cttttaaatt	aatatatgaa	tcaagaattt	tatag												1994

<210> 42
 <211> 601
 <212> PRT
 <213> Ricinus communis

<400> 42

Met	Ala	Leu	Pro	Ser	Ala	Ala	Met	Gln	Ser	Asn	Pro	Glu	Lys	Leu	Asn	
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Leu	Phe	His	Arg	Leu	Ser	Ser	Leu	Pro	Thr	Thr	Ser	Leu	Glu	Tyr	Gly	
			20					25					30			
Asn	Asn	Arg	Phe	Pro	Phe	Phe	Ser	Ser	Ser	Ala	Lys	Ser	His	Phe	Lys	
		35					40					45				
Lys	Pro	Thr	Gln	Ala	Cys	Leu	Ser	Ser	Thr	Thr	His	Gln	Glu	Val	Arg	
	50					55					60					
Pro	Leu	Ala	Tyr	Phe	Pro	Pro	Thr	Val	Trp	Gly	Asn	Arg	Phe	Ala	Ser	
65					70					75					80	
Leu	Thr	Phe	Asn	Pro	Ser	Glu	Phe	Glu	Ser	Tyr	Asp	Glu	Arg	Val	Ile	
			85					90						95		
Val	Leu	Lys	Lys	Lys	Val	Lys	Asp	Ile	Leu	Ile	Ser	Ser	Thr	Ser	Asp	
			100					105					110			
Ser	Val	Glu	Thr	Val	Ile	Leu	Ile	Asp	Leu	Leu	Cys	Arg	Leu	Gly	Val	
		115					120					125				
Ser	Tyr	His	Phe	Glu	Asn	Asp	Ile	Glu	Glu	Leu	Leu	Ser	Lys	Ile	Phe	
	130					135						140				
Asn	Ser	Gln	Pro	Asp	Leu	Val	Asp	Glu	Lys	Glu	Cys	Asp	Leu	Tyr	Thr	
145					150					155					160	
Ala	Ala	Ile	Val	Phe	Arg	Val	Phe	Arg	Gln	His	Gly	Phe	Lys	Met	Ser	
			165					170						175		
Ser	Asp	Val	Phe	Ser	Lys	Phe	Lys	Asp	Ser	Asp	Gly	Lys	Phe	Lys	Glu	
			180					185					190			

Ser	Leu	Arg	Gly	Asp	Ala	Lys	Gly	Met	Leu	Ser	Leu	Phe	Glu	Ala	Ser
		195					200					205			
His	Leu	Ser	Val	His	Gly	Glu	Asp	Ile	Leu	Glu	Glu	Ala	Phe	Ala	Phe
	210					215					220				
Thr	Lys	Asp	Tyr	Leu	Gln	Ser	Ser	Ala	Val	Glu	Leu	Phe	Pro	Asn	Leu
225					230					235					240
Lys	Arg	His	Ile	Thr	Asn	Ala	Leu	Glu	Gln	Pro	Phe	His	Ser	Gly	Val
				245					250					255	
Pro	Arg	Leu	Glu	Ala	Arg	Lys	Phe	Ile	Asp	Leu	Tyr	Glu	Ala	Asp	Ile
			260					265						270	
Glu	Cys	Arg	Asn	Glu	Thr	Leu	Leu	Glu	Phe	Ala	Lys	Leu	Asp	Tyr	Asn
		275					280						285		
Arg	Val	Gln	Leu	Leu	His	Gln	Gln	Glu	Leu	Cys	Gln	Phe	Ser	Lys	Trp
	290					295					300				
Trp	Lys	Asp	Leu	Asn	Leu	Ala	Ser	Asp	Ile	Pro	Tyr	Ala	Arg	Asp	Arg
305					310					315					320
Met	Ala	Glu	Ile	Phe	Phe	Trp	Ala	Val	Ala	Met	Tyr	Phe	Glu	Pro	Asp
				325					330					335	
Tyr	Ala	His	Thr	Arg	Met	Ile	Ile	Ala	Lys	Val	Val	Leu	Leu	Ile	Ser
			340					345						350	
Leu	Ile	Asp	Asp	Thr	Ile	Asp	Ala	Tyr	Ala	Thr	Met	Glu	Glu	Thr	His
		355					360					365			
Ile	Leu	Ala	Glu	Ala	Val	Ala	Arg	Trp	Asp	Met	Ser	Cys	Leu	Glu	Lys
	370					375					380				
Leu	Pro	Asp	Tyr	Met	Lys	Val	Ile	Tyr	Lys	Leu	Leu	Leu	Asn	Thr	Phe
385					390					395					400
Ser	Glu	Phe	Glu	Lys	Glu	Leu	Thr	Ala	Glu	Gly	Lys	Ser	Tyr	Ser	Val
				405					410					415	
Lys	Tyr	Gly	Arg	Glu	Ala	Phe	Gln	Glu	Leu	Val	Arg	Gly	Tyr	Tyr	Leu
			420					425					430		
Glu	Ala	Val	Trp	Arg	Asp	Glu	Gly	Lys	Ile	Pro	Ser	Phe	Asp	Asp	Tyr
		435					440					445			
Leu	Tyr	Asn	Gly	Ser	Met	Thr	Thr	Gly	Leu	Pro	Leu	Val	Ser	Thr	Ala
	450					455					460				
Ser	Phe	Met	Gly	Val	Gln	Glu	Ile	Thr	Gly	Leu	Asn	Glu	Phe	Gln	Trp
465					470					475					480
Leu	Glu	Thr	Asn	Pro	Lys	Leu	Ser	Tyr	Ala	Ser	Gly	Ala	Phe	Ile	Arg
				485					490					495	
Leu	Val	Asn	Asp	Leu	Thr	Ser	His	Val	Thr	Glu	Gln	Gln	Arg	Gly	His
			500					505					510		
Val	Ala	Ser	Cys	Ile	Asp	Cys	Tyr	Met	Asn	Gln	His	Gly	Val	Ser	Lys
		515					520					525			
Asp	Glu	Ala	Val	Lys	Ile	Leu	Gln	Lys	Met	Ala	Thr	Asp	Cys	Trp	Lys
	530					535					540				
Glu	Ile	Asn	Glu	Glu	Cys	Met	Arg	Gln	Ser	Gln	Val	Ser	Val	Gly	His
545					550					555					560
Leu	Met	Arg	Ile	Val	Asn	Leu	Ala	Arg	Leu	Thr	Asp	Val	Ser	Tyr	Lys
				565					570					575	
Tyr	Gly	Asp	Gly	Tyr	Thr	Asp	Ser	Gln	Gln	Leu	Lys	Gln	Phe	Val	Lys
			580					585					590		
Gly	Leu	Phe	Val	Asp	Pro	Ile	Ser	Ile							
		595					600								

<210> 43
 <211> 2700
 <212> DNA
 <213> Taxus brevifolia

<220>
 <221> CDS
 <222> (22)...(2610)
 <223> taxadiene synthase

<400> 43

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aag atg aac gca ttg ggg aac aag gca atc cac gat cca acg aat tgc	99
Lys Met Asn Ala Leu Gly Asn Lys Ala Ile His Asp Pro Thr Asn Cys	25
15 20	
aga gcc aaa tct gag cgc caa atg atg tgg gtt tgc tcc aga tca ggg	147
Arg Ala Lys Ser Glu Arg Gln Met Met Trp Val Cys Ser Arg Ser Gly	40
30 35	
cga acc aga gta aaa atg tcg aga gga agt ggt ggt cct ggt cct gtc	195
Arg Thr Arg Val Lys Met Ser Arg Gly Ser Gly Gly Pro Gly Pro Val	55
45 50	
gta atg atg agc agc agc act ggc act agc aag gtg gtt tcc gag act	243
Val Met Met Ser Ser Ser Thr Gly Thr Ser Lys Val Val Ser Glu Thr	70
60 65	
tcc agt acc att gtg gat gat atc cct cga ctc tcc gcc aat tat cat	291
Ser Ser Thr Ile Val Asp Asp Ile Pro Arg Leu Ser Ala Asn Tyr His	90
75 80 85	
ggc gat ctg tgg cac cac aat gtt ata caa act ctg gag aca ccg ttt	339
Gly Asp Leu Trp His His Asn Val Ile Gln Thr Leu Glu Thr Pro Phe	105
95 100	
cgt gag agt tct act tac caa gaa cgg gca gat gag ctg gtt gtg aaa	387
Arg Glu Ser Ser Thr Tyr Gln Glu Arg Ala Asp Glu Leu Val Val Lys	120
110 115	
att aaa gat atg ttc aat gcg ctc gga gac gga gat atc agt ccg tct	435
Ile Lys Asp Met Phe Asn Ala Leu Gly Asp Gly Asp Ile Ser Pro Ser	135
125 130 135	
gca tac gac act gcg tgg gtg gcg agg ctg gcg acc att tcc tct gat	483
Ala Tyr Asp Thr Ala Trp Val Ala Arg Leu Ala Thr Ile Ser Ser Asp	150
140 145 150	
gga tct gag aag cca cgg ttt cct cag gcc ctc aac tgg gtt ttc aac	531
Gly Ser Glu Lys Pro Arg Phe Pro Gln Ala Leu Asn Trp Val Phe Asn	

155					160					165					170	
aac	cag	ctc	cag	gat	gga	tcg	tgg	ggt	atc	gaa	tcg	cac	ttt	agt	tta	579
Asn	Gln	Leu	Gln	Asp	Gly	Ser	Trp	Gly	Ile	Glu	Ser	His	Phe	Ser	Leu	
				175					180					185		
tgc	gat	cga	ttg	ctt	aac	acg	acc	aat	tct	gtt	atc	gcc	ctc	tcg	gtr	627
Cys	Asp	Arg	Leu	Leu	Asn	Thr	Thr	Asn	Ser	Val	Ile	Ala	Leu	Ser	Val	
			190					195					200			
tgg	aaa	aca	ggg	cac	agc	caa	gta	caa	caa	ggt	gct	gag	ttt	att	gca	675
Trp	Lys	Thr	Gly	His	Ser	Gln	Val	Gln	Gln	Gly	Ala	Glu	Phe	Ile	Ala	
			205				210					215				
gag	aat	cta	aga	tta	ctc	aat	gag	gaa	gat	gag	ttg	tcc	ccg	gat	ttc	723
Glu	Asn	Leu	Arg	Leu	Leu	Asn	Glu	Glu	Asp	Glu	Leu	Ser	Pro	Asp	Phe	
	220					225					230					
caa	ata	atc	ttt	cct	gct	ctg	ctg	caa	aag	gca	aaa	gcg	ttg	ggg	atc	771
Gln	Ile	Ile	Phe	Pro	Ala	Leu	Leu	Gln	Lys	Ala	Lys	Ala	Leu	Gly	Ile	
235					240					245					250	
aat	ctt	cct	tac	gat	ctt	cca	ttt	atc	aaa	tat	ttg	tcg	aca	aca	cgg	819
Asn	Leu	Pro	Tyr	Asp	Leu	Pro	Phe	Ile	Lys	Tyr	Leu	Ser	Thr	Thr	Arg	
				255					260					265		
gaa	gcc	agg	ctt	aca	gat	gtt	tct	gcg	gca	gca	gac	aat	att	cca	gcc	867
Glu	Ala	Arg	Leu	Thr	Asp	Val	Ser	Ala	Ala	Ala	Asp	Asn	Ile	Pro	Ala	
			270					275					280			
aac	atg	ttg	aat	gcg	ttg	gaa	ggt	ctc	gag	gaa	gtt	att	gac	tgg	aac	915
Asn	Met	Leu	Asn	Ala	Leu	Glu	Gly	Leu	Glu	Glu	Val	Ile	Asp	Trp	Asn	
		285				290						295				
aag	att	atg	agg	ttt	caa	agt	aaa	gat	gga	tct	ttc	ctg	agc	tcc	cct	963
Lys	Ile	Met	Arg	Phe	Gln	Ser	Lys	Asp	Gly	Ser	Phe	Leu	Ser	Ser	Pro	
	300					305					310					
gcc	tcc	act	gcc	tgt	gta	ctg	atg	aat	aca	ggg	gac	gaa	aaa	tgt	ttc	1011
Ala	Ser	Thr	Ala	Cys	Val	Leu	Met	Asn	Thr	Gly	Asp	Glu	Lys	Cys	Phe	
315					320					325					330	
act	ttt	ctc	aac	aat	ctg	ctc	gac	aaa	ttc	ggc	ggc	tgc	gtg	ccc	tgt	1059
Thr	Phe	Leu	Asn	Asn	Leu	Leu	Asp	Lys	Phe	Gly	Gly	Cys	Val	Pro	Cys	
				335					340					345		
atg	tat	tcc	atc	gat	ctg	ctg	gaa	cgc	ctt	tcg	ctg	gtt	gat	aac	att	1107
Met	Tyr	Ser	Ile	Asp	Leu	Leu	Glu	Arg	Leu	Ser	Leu	Val	Asp	Asn	Ile	
			350					355					360			
gag	cat	ctc	gga	atc	ggt	cgc	cat	ttc	aaa	caa	gaa	atc	aaa	gga	gct	1155
Glu	His	Leu	Gly	Ile	Gly	Arg	His	Phe	Lys	Gln	Glu	Ile	Lys	Gly	Ala	
		365					370					375				

ctt gat tat gtc tac aga cat tgg agt gaa agg ggc atc ggt tgg ggc Leu Asp Tyr Val Tyr Arg His Trp Ser Glu Arg Gly Ile Gly Trp Gly 380 385 390	1203
aga gac agc ctt gtt cca gat ctc aac acc aca gcc ctc ggc ctg cga Arg Asp Ser Leu Val Pro Asp Leu Asn Thr Thr Ala Leu Gly Leu Arg 395 400 405 410	1251
act ctt cgc atg cac gga tac aat gtt tct tca gac gtt ttg aat aat Thr Leu Arg Met His Gly Tyr Asn Val Ser Ser Asp Val Leu Asn Asn 415 420 425	1299
ttc aaa gat gaa aac ggg cgg ttc ttc tcc tct gcg ggc caa acc cat Phe Lys Asp Glu Asn Gly Arg Phe Phe Ser Ser Ala Gly Gln Thr His 430 435 440	1347
gtc gaa ttg aga agc gtg gtg aat ctt ttc aga gct tcc gac ctt gca Val Glu Leu Arg Ser Val Val Asn Leu Phe Arg Ala Ser Asp Leu Ala 445 450 455	1395
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Pro	Tyr	Val	Asn	Asn	Glu	Lys	Phe	Leu	Glu	Leu	Gly	Lys	Leu	Asp	Phe	
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aac	att	atc	cag	tcc	atc	cac	caa	gaa	gaa	atg	aag	aat	gtt	acc	agc	1441
Asn	Ile	Ile	Gln	Ser	Ile	His	Gln	Glu	Glu	Met	Lys	Asn	Val	Thr	Ser	

465				470				475				480				
tgg	ttt	aga	gat	tcg	ggg	ttg	cca	cta	ttc	acc	ttc	gct	cgg	gag	agg	1489
Trp	Phe	Arg	Asp	Ser	Gly	Leu	Pro	Leu	Phe	Thr	Phe	Ala	Arg	Glu	Arg	
				485					490					495		
ccg	ctg	gaa	ttc	tac	ttc	tta	gta	gcg	gcg	ggg	acc	tat	gaa	ccc	cag	1537
Pro	Leu	Glu	Phe	Tyr	Phe	Leu	Val	Ala	Ala	Gly	Thr	Tyr	Glu	Pro	Gln	
			500					505					510			
tat	gcc	aaa	tgc	agg	ttc	ctc	ttt	aca	aaa	gtg	gca	tgc	ttg	cag	act	1585
Tyr	Ala	Lys	Cys	Arg	Phe	Leu	Phe	Thr	Lys	Val	Ala	Cys	Leu	Gln	Thr	
		515					520					525				
gtt	ctg	gac	gat	atg	tat	gac	act	tat	gga	acc	cta	gat	gaa	ttg	aag	1633
Val	Leu	Asp	Asp	Met	Tyr	Asp	Thr	Tyr	Gly	Thr	Leu	Asp	Glu	Leu	Lys	
	530					535					540					
cta	ttc	act	gag	gct	gtg	aga	aga	tgg	gac	ctc	tcc	ttt	aca	gaa	aac	1681
Leu	Phe	Thr	Glu	Ala	Val	Arg	Arg	Trp	Asp	Leu	Ser	Phe	Thr	Glu	Asn	
545					550					555					560	
ctt	cca	gac	tat	atg	aaa	cta	tgt	tac	caa	atc	tat	tat	gac	ata	gtt	1729
Leu	Pro	Asp	Tyr	Met	Lys	Leu	Cys	Tyr	Gln	Ile	Tyr	Tyr	Asp	Ile	Val	
				565					570					575		
cac	gag	gtg	gct	tgg	gag	gca	gag	aag	gaa	cag	ggg	cgt	gaa	ttg	gtc	1777
His	Glu	Val	Ala	Trp	Glu	Ala	Glu	Lys	Glu	Gln	Gly	Arg	Glu	Leu	Val	
			580					585					590			
agc	ttt	ttc	aga	aag	gga	tgg	gag	gat	tat	ctt	ctg	ggt	tat	tat	gaa	1825
Ser	Phe	Phe	Arg	Lys	Gly	Trp	Glu	Asp	Tyr	Leu	Leu	Gly	Tyr	Tyr	Glu	
		595					600					605				
gaa	gct	gaa	tgg	tta	gct	gct	gag	tat	gtg	cct	acc	ttg	gac	gag	tac	1873
Glu	Ala	Glu	Trp	Leu	Ala	Ala	Glu	Tyr	Val	Pro	Thr	Leu	Asp	Glu	Tyr	
	610					615					620					
ata	aag	aat	gga	atc	aca	tct	atc	ggc	caa	cgt	ata	ctt	ctg	ttg	agt	1921
Ile	Lys	Asn	Gly	Ile	Thr	Ser	Ile	Gly	Gln	Arg	Ile	Leu	Leu	Leu	Ser	
625					630					635					640	
gga	gtg	ttg	ata	atg	gat	ggg	caa	ctc	ctt	tcg	caa	gag	gca	tta	gag	1969
Gly	Val	Leu	Ile	Met	Asp	Gly	Gln	Leu	Leu	Ser	Gln	Glu	Ala	Leu	Glu	
				645					650					655		
aaa	gta	gat	tat	cca	gga	aga	cgt	gtt	ctc	aca	gag	ctg	aat	agc	ctc	2017
Lys	Val	Asp	Tyr	Pro	Gly	Arg	Arg	Val	Leu	Thr	Glu	Leu	Asn	Ser	Leu	
			660					665					670			
att	tcc	cgc	ctg	gcg	gat	gac	acg	aag	aca	tat	aaa	gct	gag	aag	gct	2065
Ile	Ser	Arg	Leu	Ala	Asp	Asp	Thr	Lys	Thr	Tyr	Lys	Ala	Glu	Lys	Ala	
		675					680					685				

cgt gga gaa ttg gcg tcc agc att gaa tgt tac atg aaa gac cat cct	2113
Arg Gly Glu Leu Ala Ser Ser Ile Glu Cys Tyr Met Lys Asp His Pro	
690 695 700	
gaa tgt aca gag gaa gag gct ctc gat cac atc tat agc att ctg gag	2161
Glu Cys Thr Glu Glu Glu Ala Leu Asp His Ile Tyr Ser Ile Leu Glu	
705 710 715 720	
ccg gcg gtg aag gaa ctg aca aga gag ttt ctg aag ccc gac gac gtc	2209
Pro Ala Val Lys Glu Leu Thr Arg Glu Phe Leu Lys Pro Asp Asp Val	
725 730 735	
cca ttc gcc tgc aag aag atg ctt ttc gag gag aca aga gtg acg atg	2257
Pro Phe Ala Cys Lys Lys Met Leu Phe Glu Glu Thr Arg Val Thr Met	
740 745 750	
gtg ata ttc aag gat gga gat gga ttc ggt gtt tcc aaa tta gaa gtc	2305
Val Ile Phe Lys Asp Gly Asp Gly Phe Gly Val Ser Lys Leu Glu Val	
755 760 765	
aaa gat cat atc aaa gag tgt ctc att gaa ccg ctg cca ctg taa	2350
Lys Asp His Ile Lys Glu Cys Leu Ile Glu Pro Leu Pro Leu *	
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 <212> PRT
 <213> *Abies grandis*

<400> 46

Gly Tyr Asp Leu Val His Ser Leu Lys Ser Pro Tyr Ile Asp Ser Ser	1 5 10 15
Tyr Arg Glu Arg Ala Glu Val Leu Val Ser Glu Ile Lys Val Met Leu	20 25 30
Asn Pro Ala Ile Thr Gly Asp Gly Glu Ser Met Ile Thr Pro Ser Ala	35 40 45
Tyr Asp Thr Ala Trp Val Ala Arg Val Pro Ala Ile Asp Gly Ser Ala	50 55 60
Arg Pro Gln Phe Pro Gln Thr Val Asp Trp Ile Leu Lys Asn Gln Leu	65 70 75 80
Lys Asp Gly Ser Trp Gly Ile Gln Ser His Phe Leu Leu Ser Asp Arg	85 90 95
Leu Leu Ala Thr Leu Ser Cys Val Leu Val Leu Leu Lys Trp Asn Val	100 105 110
Gly Asp Leu Gln Val Glu Gln Gly Ile Glu Phe Ile Lys Ser Asn Leu	115 120 125
Glu Leu Val Lys Asp Glu Thr Asp Gln Asp Ser Leu Val Thr Asp Phe	130 135 140
Glu Ile Ile Phe Pro Ser Leu Leu Arg Glu Ala Gln Ser Leu Arg Leu	

145	Gly	Leu	Pro	Tyr	Asp	150	Leu	Pro	Tyr	Ile	His	155	Leu	Leu	Gln	Thr	Lys	160	Arg
					165						170						175		
	Gln	Glu	Arg	Leu	Ala	Lys	Leu	Ser	Arg	Glu	Glu	Ile	Tyr	Ala	Val	Pro			
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	Ser	Pro	Leu	Leu	Tyr	Ser	Leu	Glu	Gly	Ile	Gln	Asp	Ile	Val	Glu	Trp			
			195					200					205						
	Glu	Arg	Ile	Met	Glu	Val	Gln	Ser	Gln	Asp	Gly	Ser	Phe	Leu	Ser	Ser			
		210					215					220							
	Pro	Ala	Ser	Thr	Ala	Cys	Val	Phe	Met	His	Thr	Gly	Asp	Ala	Lys	Cys			
225					230						235					240			
	Leu	Glu	Phe	Leu	Asn	Ser	Val	Met	Ile	Lys	Phe	Gly	Asn	Phe	Val	Pro			
				245						250					255				
	Cys	Leu	Tyr	Pro	Val	Asp	Leu	Leu	Glu	Arg	Leu	Leu	Ile	Val	Asp	Asn			
			260						265					270					
	Ile	Val	Arg	Leu	Gly	Ile	Tyr	Arg	His	Phe	Glu	Lys	Glu	Ile	Lys	Glu			
		275						280					285						
	Ala	Leu	Asp	Tyr	Val	Tyr	Arg	His	Trp	Asn	Glu	Arg	Gly	Ile	Gly	Trp			
		290					295					300							
	Gly	Arg	Leu	Asn	Pro	Ile	Ala	Asp	Leu	Glu	Thr	Thr	Ala	Leu	Gly	Phe			
305					310						315					320			
	Arg	Leu	Leu	Arg	Leu	His	Arg	Tyr	Asn	Val	Ser	Pro	Ala	Ile	Phe	Asp			
				325					330						335				
	Asn	Phe	Lys	Asp	Ala	Asn	Gly	Lys	Phe	Ile	Cys	Ser	Thr	Gly	Gln	Phe			
			340						345					350					
	Asn	Lys	Asp	Val	Ala	Ser	Met	Leu	Asn	Leu	Tyr	Arg	Ala	Ser	Gln	Leu			
		355						360					365						
	Ala	Phe	Pro	Gly	Glu	Asn	Ile	Leu	Asp	Glu	Ala	Lys	Ser	Phe	Ala	Thr			
		370				375						380							
	Lys	Tyr	Leu	Arg	Glu	Ala	Leu	Glu	Lys	Ser	Glu	Thr	Ser	Ser	Ala	Trp			
385					390						395					400			
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			420						425					430					
	Val	Tyr	Arg	Pro	Asp	Tyr	Ala	Arg	Ile	Ala	Lys	Cys	Val	Tyr	Lys	Leu			
		435						440					445						
	Pro	Tyr	Val	Asn	Asn	Glu	Lys	Phe	Leu	Glu	Leu	Gly	Lys	Leu	Asp	Phe			
		450				455						460							
	Asn	Ile	Ile	Gln	Ser	Ile	His	Gln	Glu	Glu	Met	Lys	Asn	Val	Thr	Ser			
465					470						475					480			
	Trp	Phe	Arg	Asp	Ser	Gly	Leu	Pro	Leu	Phe	Thr	Phe	Ala	Arg	Glu	Arg			
				485					490						495				
	Pro	Leu	Glu	Phe	Tyr	Phe	Leu	Val	Ala	Ala	Gly	Thr	Tyr	Glu	Pro	Gln			
			500						505					510					
	Tyr	Ala	Lys	Cys	Arg	Phe	Leu	Phe	Thr	Lys	Val	Ala	Cys	Leu	Gln	Thr			
		515						520					525						
	Val	Leu	Asp	Asp	Met	Tyr	Asp	Thr	Tyr	Gly	Thr	Leu	Asp	Glu	Leu	Lys			
		530				535						540							
	Leu	Phe	Thr	Glu	Ala	Val	Arg	Arg	Trp	Asp	Leu	Ser	Phe	Thr	Glu	Asn			
545					550						555					560			
	Leu	Pro	Asp	Tyr	Met	Lys	Leu	Cys	Tyr	Gln	Ile	Tyr	Tyr	Asp	Ile	Val			
				565						570					575				

His	Glu	Val	Ala	Trp	Glu	Ala	Glu	Lys	Glu	Gln	Gly	Arg	Glu	Leu	Val	
			580					585					590			
Ser	Phe	Phe	Arg	Lys	Gly	Trp	Glu	Asp	Tyr	Leu	Leu	Gly	Tyr	Tyr	Glu	
		595					600					605				
Glu	Ala	Glu	Trp	Leu	Ala	Ala	Glu	Tyr	Val	Pro	Thr	Leu	Asp	Glu	Tyr	
	610				615						620					
Ile	Lys	Asn	Gly	Ile	Thr	Ser	Ile	Gly	Gln	Arg	Ile	Leu	Leu	Leu	Ser	
625					630					635					640	
Gly	Val	Leu	Ile	Met	Asp	Gly	Gln	Leu	Leu	Ser	Gln	Glu	Ala	Leu	Glu	
				645					650					655		
Lys	Val	Asp	Tyr	Pro	Gly	Arg	Arg	Val	Leu	Thr	Glu	Leu	Asn	Ser	Leu	
		660						665					670			
Ile	Ser	Arg	Leu	Ala	Asp	Asp	Thr	Lys	Thr	Tyr	Lys	Ala	Glu	Lys	Ala	
		675					680					685				
Arg	Gly	Glu	Leu	Ala	Ser	Ser	Ile	Glu	Cys	Tyr	Met	Lys	Asp	His	Pro	
	690					695					700					
Glu	Cys	Thr	Glu	Glu	Glu	Ala	Leu	Asp	His	Ile	Tyr	Ser	Ile	Leu	Glu	
705					710					715					720	
Pro	Ala	Val	Lys	Glu	Leu	Thr	Arg	Glu	Phe	Leu	Lys	Pro	Asp	Asp	Val	
			725						730					735		
Pro	Phe	Ala	Cys	Lys	Lys	Met	Leu	Phe	Glu	Glu	Thr	Arg	Val	Thr	Met	
		740						745					750			
Val	Ile	Phe	Lys	Asp	Gly	Asp	Gly	Phe	Gly	Val	Ser	Lys	Leu	Glu	Val	
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 <220>
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 <223> d-selinene synthase

<400> 47

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Met	Ala	Glu	Ile	Ser	Glu	Ser	Ser	Ile	Pro	Arg	Arg	Thr	Gly	Asn	His	
1				5					10					15		
cac	gga	aat	gtg	tgg	gac	gat	gac	ctc	ata	cac	tct	ctc	aac	tcg	ccc	96
His	Gly	Asn	Val	Trp	Asp	Asp	Asp	Leu	Ile	His	Ser	Leu	Asn	Ser	Pro	
			20					25					30			
tat	ggg	gca	cct	gca	tat	tat	gag	ctc	ctt	caa	aag	ctt	att	cag	gag	144
Tyr	Gly	Ala	Pro	Ala	Tyr	Tyr	Glu	Leu	Leu	Gln	Lys	Leu	Ile	Gln	Glu	
		35					40					45				
atc	aag	cat	tta	ctt	ttg	act	gaa	atg	gaa	atg	gat	gat	ggc	gat	cat	192
Ile	Lys	His	Leu	Leu	Leu	Thr	Glu	Met	Glu	Met	Asp	Asp	Gly	Asp	His	
	50					55					60					

gat	tta	atc	aaa	cgt	ctt	cag	atc	gtt	gac	act	ttg	gaa	tgc	ctg	gga	240
Asp	Leu	Ile	Lys	Arg	Leu	Gln	Ile	Val	Asp	Thr	Leu	Glu	Cys	Leu	Gly	
65					70					75					80	
atc	gat	aga	cat	ttt	gaa	cac	gaa	ata	caa	aca	gct	gct	tta	gat	tac	288
Ile	Asp	Arg	His	Phe	Glu	His	Glu	Ile	Gln	Thr	Ala	Ala	Leu	Asp	Tyr	
				85					90					95		
gtt	tac	aga	tgg	tgg	aac	gaa	aaa	ggg	atc	ggg	gag	gga	tca	aga	gat	336
Val	Tyr	Arg	Trp	Trp	Asn	Glu	Lys	Gly	Ile	Gly	Glu	Gly	Ser	Arg	Asp	
			100					105					110			
tcc	ttc	agc	aaa	gat	ctg	aac	gct	acg	gct	tta	gga	ttt	cgc	gct	ctc	384
Ser	Phe	Ser	Lys	Asp	Leu	Asn	Ala	Thr	Ala	Leu	Gly	Phe	Arg	Ala	Leu	
		115					120					125				
cga	ctg	cat	cga	tat	aac	gta	tcg	tca	ggg	gtg	ttg	aag	aat	ttc	aag	432
Arg	Leu	His	Arg	Tyr	Asn	Val	Ser	Ser	Gly	Val	Leu	Lys	Asn	Phe	Lys	
	130					135					140					
gat	gaa	aac	ggg	aag	ttc	ttc	tgc	aac	ttt	act	ggg	gaa	gaa	gga	aga	480
Asp	Glu	Asn	Gly	Lys	Phe	Phe	Cys	Asn	Phe	Thr	Gly	Glu	Glu	Gly	Arg	
145					150					155					160	
gga	gat	aaa	caa	gtg	aga	agc	atg	ttg	tcg	tta	ctt	cga	gct	tca	gag	528
Gly	Asp	Lys	Gln	Val	Arg	Ser	Met	Leu	Ser	Leu	Leu	Arg	Ala	Ser	Glu	
				165				170					175			
att	tcg	ttt	ccc	gga	gaa	aaa	gtg	atg	gaa	gag	gcc	aag	gca	ttc	aca	576
Ile	Ser	Phe	Pro	Gly	Glu	Lys	Val	Met	Glu	Glu	Ala	Lys	Ala	Phe	Thr	
			180					185					190			
aga	gaa	tat	cta	aac	caa	gtt	tta	gct	gga	cac	ggg	gat	gtg	act	gac	624
Arg	Glu	Tyr	Leu	Asn	Gln	Val	Leu	Ala	Gly	His	Gly	Asp	Val	Thr	Asp	
		195					200					205				
gtg	gat	caa	agc	ctt	ttg	aga	gag	gtg	aag	tac	gca	ttg	gag	ttt	cca	672
Val	Asp	Gln	Ser	Leu	Leu	Arg	Glu	Val	Lys	Tyr	Ala	Leu	Glu	Phe	Pro	
	210					215					220					
tgg	cat	tgc	agt	gtg	ccg	aga	tgg	gag	gca	agg	agc	ttt	ctc	gaa	ata	720
Trp	His	Cys	Ser	Val	Pro	Arg	Trp	Glu	Ala	Arg	Ser	Phe	Leu	Glu	Ile	
225					230					235					240	
tat	gga	cac	aac	cat	tcg	tgg	ctc	aag	tcg	aat	atc	aac	caa	aaa	atg	768
Tyr	Gly	His	Asn	His	Ser	Trp	Leu	Lys	Ser	Asn	Ile	Asn	Gln	Lys	Met	
				245					250					255		
ttg	aag	tta	gcc	aaa	ttg	gac	ttc	aat	att	ctg	caa	tgc	aaa	cat	cac	816
Leu	Lys	Leu	Ala	Lys	Leu	Asp	Phe	Asn	Ile	Leu	Gln	Cys	Lys	His	His	
			260					265					270			

aag	gag	ata	cag	ttt	att	aca	agg	tgg	tgg	aga	gac	tcg	ggg	ata	tcg	864
Lys	Glu	Ile	Gln	Phe	Ile	Thr	Arg	Trp	Trp	Arg	Asp	Ser	Gly	Ile	Ser	
		275					280					285				
cag	ctg	aat	ttc	tat	cga	aag	cga	cac	gtg	gaa	tat	tat	tct	tgg	gtt	912
Gln	Leu	Asn	Phe	Tyr	Arg	Lys	Arg	His	Val	Glu	Tyr	Tyr	Ser	Trp	Val	
	290					295					300					
gtt	atg	tgc	att	ttt	gag	cca	gag	ttc	tct	gaa	agt	aga	att	gcc	ttc	960
Val	Met	Cys	Ile	Phe	Glu	Pro	Glu	Phe	Ser	Glu	Ser	Arg	Ile	Ala	Phe	
305					310					315					320	
gcc	aaa	act	gct	atc	ctg	tgt	act	gtt	cta	gat	gac	ctc	tat	gat	acg	1008
Ala	Lys	Thr	Ala	Ile	Leu	Cys	Thr	Val	Leu	Asp	Asp	Leu	Tyr	Asp	Thr	
				325					330					335		
cac	gca	aca	ttg	cat	gaa	atc	aaa	atc	atg	aca	gag	gga	gtg	aga	cga	1056
His	Ala	Thr	Leu	His	Glu	Ile	Lys	Ile	Met	Thr	Glu	Gly	Val	Arg	Arg	
			340					345					350			
tgg	gat	ctt	tcg	ttg	aca	gat	gac	ctc	cca	gac	tac	att	aaa	att	gca	1104
Trp	Asp	Leu	Ser	Leu	Thr	Asp	Asp	Leu	Pro	Asp	Tyr	Ile	Lys	Ile	Ala	
		355					360					365				
ttc	cag	ttc	ttc	ttc	aat	aca	gtg	aat	gaa	ttg	ata	gtt	gaa	atc	gtg	1152
Phe	Gln	Phe	Phe	Phe	Asn	Thr	Val	Asn	Glu	Leu	Ile	Val	Glu	Ile	Val	
	370					375					380					
aaa	cgg	caa	ggg	cgg	gat	atg	aca	acc	ata	gtt	aaa	gat	tgc	tgg	aag	1200
Lys	Arg	Gln	Gly	Arg	Asp	Met	Thr	Thr	Ile	Val	Lys	Asp	Cys	Trp	Lys	
385					390					395					400	
cga	tac	att	gag	tct	tat	ctg	caa	gaa	gcg	gaa	tgg	ata	gca	act	gga	1248
Arg	Tyr	Ile	Glu	Ser	Tyr	Leu	Gln	Glu	Ala	Glu	Trp	Ile	Ala	Thr	Gly	
			405					410						415		
cat	att	ccc	act	ttt	aac	gaa	tac	ata	aag	aac	ggc	atg	gct	agc	tca	1296
His	Ile	Pro	Thr	Phe	Asn	Glu	Tyr	Ile	Lys	Asn	Gly	Met	Ala	Ser	Ser	
			420					425					430			
ggg	atg	tgt	att	cta	aat	ttg	aat	cca	ctt	ctc	ttg	ttg	gat	aaa	ctt	1344
Gly	Met	Cys	Ile	Leu	Asn	Leu	Asn	Pro	Leu	Leu	Leu	Leu	Asp	Lys	Leu	
		435					440					445				
ctc	ccc	gac	aac	att	ctg	gag	caa	ata	cat	tct	cca	tcc	aag	atc	ctg	1392
Leu	Pro	Asp	Asn	Ile	Leu	Glu	Gln	Ile	His	Ser	Pro	Ser	Lys	Ile	Leu	
	450					455					460					
gac	ctc	tta	gaa	ttg	acg	ggc	aga	atc	gcc	gat	gac	tta	aaa	gat	ttc	1440
Asp	Leu	Leu	Glu	Leu	Thr	Gly	Arg	Ile	Ala	Asp	Asp	Leu	Lys	Asp	Phe	
465					470					475					480	
gag	gac	gag	aag	gaa	cgc	ggg	gag	atg	gct	tca	tct	tta	cag	tgt	tat	1488

Glu	Asp	Glu	Lys	Glu	Arg	Gly	Glu	Met	Ala	Ser	Ser	Leu	Gln	Cys	Tyr		
				485					490					495			
atg	aaa	gaa	aat	cct	gaa	tct	aca	gtg	gaa	aat	gct	tta	aac	cac	ata		1536
Met	Lys	Glu	Asn	Pro	Glu	Ser	Thr	Val	Glu	Asn	Ala	Leu	Asn	His	Ile		
			500					505					510				
aaa	ggc	atc	ctt	aat	cgt	tcc	ctt	gag	gaa	ttt	aat	tgg	gag	ttt	atg		1584
Lys	Gly	Ile	Leu	Asn	Arg	Ser	Leu	Glu	Glu	Phe	Asn	Trp	Glu	Phe	Met		
		515					520					525					
aag	cag	gat	agt	gtc	cca	atg	tgt	tgc	aag	aaa	ttc	act	ttc	aat	ata		1632
Lys	Gln	Asp	Ser	Val	Pro	Met	Cys	Cys	Lys	Lys	Phe	Thr	Phe	Asn	Ile		
	530					535					540						
ggc	cga	gga	ctt	caa	ttc	atc	tac	aaa	tac	aga	gac	ggc	tta	tac	att		1680
Gly	Arg	Gly	Leu	Gln	Phe	Ile	Tyr	Lys	Tyr	Arg	Asp	Gly	Leu	Tyr	Ile		
545				550					555						560		
tct	gac	aag	gaa	gta	aag	gac	cag	ata	ttc	aaa	att	cta	gtc	cac	caa		1728
Ser	Asp	Lys	Glu	Val	Lys	Asp	Gln	Ile	Phe	Lys	Ile	Leu	Val	His	Gln		
				565				570						575			
gtt	cca	atg	gag	gaa	tag	tgatgggtctt	ggttgtagtt	gtctattatg									1776
Val	Pro	Met	Glu	Glu	*												
			580														
gtatat	ttgca	ttgacatt	ttta	tgcttaa	aagg	tgctttct	tttaa	acgttttag	ggg	cggacc	ggtta						1836
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<210> 48
 <211> 581
 <212> PRT
 <213> Abies grandis

<400> 48																	
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His	Gly	Asn	Val	Trp	Asp	Asp	Asp	Leu	Ile	His	Ser	Leu	Asn	Ser	Pro		
			20					25					30				
Tyr	Gly	Ala	Pro	Ala	Tyr	Tyr	Glu	Leu	Leu	Gln	Lys	Leu	Ile	Gln	Glu		
		35					40					45					
Ile	Lys	His	Leu	Leu	Leu	Thr	Glu	Met	Glu	Met	Asp	Asp	Gly	Asp	His		
	50					55					60						
Asp	Leu	Ile	Lys	Arg	Leu	Gln	Ile	Val	Asp	Thr	Leu	Glu	Cys	Leu	Gly		
65				70					75					80			
Ile	Asp	Arg	His	Phe	Glu	His	Glu	Ile	Gln	Thr	Ala	Ala	Leu	Asp	Tyr		
			85					90						95			
Val	Tyr	Arg	Trp	Trp	Asn	Glu	Lys	Gly	Ile	Gly	Glu	Gly	Ser	Arg	Asp		
			100					105					110				
Ser	Phe	Ser	Lys	Asp	Leu	Asn	Ala	Thr	Ala	Leu	Gly	Phe	Arg	Ala	Leu		
		115				120						125					
Arg	Leu	His	Arg	Tyr	Asn	Val	Ser	Ser	Gly	Val	Leu	Lys	Asn	Phe	Lys		

130	135	140
Asp Glu Asn Gly Lys Phe	Phe Cys Asn Phe Thr	Gly Glu Glu Gly Arg
145	150	155
Gly Asp Lys Gln Val Arg	Ser Met Leu Ser Leu	Leu Arg Ala Ser Glu
165	170	175
Ile Ser Phe Pro Gly Glu	Lys Val Met Glu Glu	Ala Lys Ala Phe Thr
180	185	190
Arg Glu Tyr Leu Asn Gln	Val Leu Ala Gly His	Gly Asp Val Thr Asp
195	200	205
Val Asp Gln Ser Leu Leu	Arg Glu Val Lys Tyr	Ala Leu Glu Phe Pro
210	215	220
Trp His Cys Ser Val Pro	Arg Trp Glu Ala Arg	Ser Phe Leu Glu Ile
225	230	235
Tyr Gly His Asn His Ser	Trp Leu Lys Ser Asn	Ile Asn Gln Lys Met
245	250	255
Leu Lys Leu Ala Lys Leu	Asp Phe Asn Ile Leu	Gln Cys Lys His His
260	265	270
Lys Glu Ile Gln Phe Ile	Thr Arg Trp Trp Arg	Asp Ser Gly Ile Ser
275	280	285
Gln Leu Asn Phe Tyr Arg	Lys Arg His Val Glu	Tyr Tyr Ser Trp Val
290	295	300
Val Met Cys Ile Phe Glu	Pro Glu Phe Ser Glu	Ser Arg Ile Ala Phe
305	310	315
Ala Lys Thr Ala Ile Leu	Cys Thr Val Leu Asp	Asp Leu Tyr Asp Thr
325	330	335
His Ala Thr Leu His Glu	Ile Lys Ile Met Thr	Glu Gly Val Arg Arg
340	345	350
Trp Asp Leu Ser Leu Thr	Asp Asp Leu Pro Asp	Tyr Ile Lys Ile Ala
355	360	365
Phe Gln Phe Phe Phe Asn	Thr Val Asn Glu Leu	Ile Val Glu Ile Val
370	375	380
Lys Arg Gln Gly Arg Asp	Met Thr Thr Ile Val	Lys Asp Cys Trp Lys
385	390	395
Arg Tyr Ile Glu Ser Tyr	Leu Gln Glu Ala Glu	Trp Ile Ala Thr Gly
405	410	415
His Ile Pro Thr Phe Asn	Glu Tyr Ile Lys Asn	Gly Met Ala Ser Ser
420	425	430
Gly Met Cys Ile Leu Asn	Leu Asn Pro Leu Leu	Leu Leu Asp Lys Leu
435	440	445
Leu Pro Asp Asn Ile Leu	Glu Gln Ile His Ser	Pro Ser Lys Ile Leu
450	455	460
Asp Leu Leu Glu Leu Thr	Gly Arg Ile Ala Asp	Asp Leu Lys Asp Phe
465	470	475
Glu Asp Glu Lys Glu Arg	Gly Glu Met Ala Ser	Ser Ser Leu Gln Cys Tyr
485	490	495
Met Lys Glu Asn Pro Glu	Ser Thr Val Glu Asn	Ala Leu Asn His Ile
500	505	510
Lys Gly Ile Leu Asn Arg	Ser Leu Glu Glu Phe	Asn Trp Glu Phe Met
515	520	525
Lys Gln Asp Ser Val Pro	Met Cys Cys Lys Lys	Phe Thr Phe Asn Ile
530	535	540
Gly Arg Gly Leu Gln Phe	Ile Tyr Lys Tyr Arg	Asp Gly Leu Tyr Ile
545	550	555
		560

Ser Asp Lys Glu Val Lys Asp Gln Ile Phe Lys Ile Leu Val His Gln
565 570 575
Val Pro Met Glu Glu
580

<210> 49
<211> 1785
<212> DNA
<213> *Abies grandis*

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<223> gamma-humulene synthase

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1 5 10
agc acc gaa tct tcc att acc tct aat cga cat gga aat atg tgg gag 96
Ser Thr Glu Ser Ser Ile Thr Ser Asn Arg His Gly Asn Met Trp Glu 30
20 25
gac gat cgc ata cag tct ctc aac tca cct tat ggg gca cct gca tat 144
Asp Asp Arg Ile Gln Ser Leu Asn Ser Pro Tyr Gly Ala Pro Ala Tyr 45
35 40
caa gaa cgc agc gaa aag ctt att gaa gag atc aaa ctt tta ttt ttg 192
Gln Glu Arg Ser Glu Lys Leu Ile Glu Glu Ile Lys Leu Leu Phe Leu 60
50 55
agt gac atg gac gat agc tgc aat gat agc gat cgt gat tta atc aaa 240
Ser Asp Met Asp Asp Ser Cys Asn Asp Ser Asp Arg Asp Leu Ile Lys 75
65 70
cgt ctt gag atc gtt gat act gtc gag tgt ctg gga att gat cga cat 288
Arg Leu Glu Ile Val Asp Thr Val Glu Cys Leu Gly Ile Asp Arg His 95
80 85 90
ttt caa cct gag ata aaa tta gct ctg gat tac gtt tac aga tgt tgg 336
Phe Gln Pro Glu Ile Lys Leu Ala Leu Asp Tyr Val Tyr Arg Cys Trp 110
100 105
aac gaa aga ggc atc gga gag gga tca aga gat tcc ctc aag aaa gat 384
Asn Glu Arg Gly Ile Gly Glu Gly Ser Arg Asp Ser Leu Lys Lys Asp 125
115 120
ctg aac gct aca gct ttg gga ttc cgg gct ctc cga ctc cat cga tat 432
Leu Asn Ala Thr Ala Leu Gly Phe Arg Ala Leu Arg Leu His Arg Tyr 140
130 135
aac gta tcc tca ggt gtc ttg gag aat ttc aga gat gat aac ggg cag 480

Asn 145	Val	Ser	Ser	Gly	Val	Leu 150	Glu	Asn	Phe	Arg	Asp 155	Asp	Asn	Gly	Gln	
ttc Phe 160	ttc Phe	tgc Cys	ggg Gly	tct Ser	aca Thr 165	gtt Val	gaa Glu	gaa Glu	gaa Glu	gga Gly 170	gca Ala	gaa Glu	gca Ala	tat Tyr	aat Asn 175	528
aaa Lys	cac His	gta Val	aga Arg	tgc Cys 180	atg Met	ctg Leu	tca Ser	tta Leu	tcg Ser 185	cga Arg	gct Ala	tca Ser	aac Asn	att Ile 190	tta Leu	576
ttt Phe	ccg Pro	ggc Gly	gaa Glu 195	aaa Lys	gtg Val	atg Met	gaa Glu	gag Glu 200	gcg Ala	aag Lys	gca Ala	ttc Phe	aca Thr 205	aca Thr	aat Asn	624
tat Tyr	cta Leu	aag Lys 210	aaa Lys	gtt Val	tta Leu	gca Ala	gga Gly 215	cgg Arg	gag Glu	gct Ala	acc Thr	cac His 220	gtc Val	gat Asp	gaa Glu	672
agc Ser 225	ctt Leu	ttg Leu	gga Gly	gag Glu	gtg Val	aag Lys 230	tac Tyr	gca Ala	ttg Leu	gag Glu	ttt Phe 235	cca Pro	tgg Trp	cat His	tgc Cys	720
agt Ser 240	gtg Val	cag Gln	aga Arg	tgg Trp	gag Glu 245	gca Ala	agg Arg	agc Ser	ttt Phe	atc Ile 250	gaa Glu	ata Ile	ttt Phe	gga Gly	caa Gln 255	768
att Ile	gat Asp	tca Ser	gag Glu	ctt Leu 260	aag Lys	tcg Ser	aat Asn	ttg Leu	agc Ser 265	aaa Lys	aaa Lys	atg Met	tta Leu	gag Glu 270	ttg Leu	816
gcg Ala	aaa Lys	ttg Leu	gac Asp 275	ttc Phe	aat Asn	att Ile	ctg Leu 280	caa Gln	tgc Cys	aca Thr	cat His	cag Gln	aaa Lys 285	gaa Glu	ctg Leu	864
cag Gln	att Ile	atc Ile 290	tca Ser	agg Arg	tgg Trp	ttc Phe	gca Ala 295	gac Asp	tca Ser	agt Ser	ata Ile	gca Ala 300	tcc Ser	ctg Leu	aat Asn	912
ttc Phe 305	tat Tyr	cgg Arg	aaa Lys	tgt Cys	tac Tyr 310	gtc Val	gaa Glu	ttt Phe	tac Tyr	ttt Phe	tgg Trp 315	atg Met	gct Ala	gca Ala	gcc Ala	960
atc Ile 320	tcc Ser	gag Glu	ccg Pro	gag Glu	ttt Phe 325	tct Ser	gga Gly	agc Ser	aga Arg	gtt Val 330	gcc Ala	ttc Phe	aca Thr	aaa Lys	att Ile 335	1008
gct Ala	ata Ile	ctg Leu	atg Met	aca Thr 340	atg Met	cta Leu	gat Asp	gac Asp	ctg Leu 345	tac Tyr	gat Asp	act Thr	cac His	gga Gly 350	acc Thr	1056
ttg Leu	gac Asp	caa Gln	ctc Leu	aaa Lys	atc Ile	ttt Phe	aca Thr	gag Glu	gga Gly	gtg Val	aga Arg	cga Arg	tgg Trp	gat Asp	gtt Val	1104

355						360						365						
tcg	ttg	gta	gag	ggc	ctc	cca	gac	ttc	atg	aaa	att	gca	ttc	gag	ttc			1152
Ser	Leu	Val	Glu	Gly	Leu	Pro	Asp	Phe	Met	Lys	Ile	Ala	Phe	Glu	Phe			
		370					375					380						
tgg	tta	aag	aca	tct	aat	gaa	ttg	att	gct	gaa	gct	gtt	aaa	gcg	caa			1200
Trp	Leu	Lys	Thr	Ser	Asn	Glu	Leu	Ile	Ala	Glu	Ala	Val	Lys	Ala	Gln			
		385					390				395							
ggg	caa	gat	atg	gcg	gcc	tac	ata	aga	aaa	aat	gca	tgg	gag	cga	tac			1248
Gly	Gln	Asp	Met	Ala	Ala	Tyr	Ile	Arg	Lys	Asn	Ala	Trp	Glu	Arg	Tyr			
		400			405					410					415			
ctt	gaa	gct	tat	ctg	caa	gat	gcg	gaa	tgg	ata	gcc	act	gga	cat	gtc			1296
Leu	Glu	Ala	Tyr	Leu	Gln	Asp	Ala	Glu	Trp	Ile	Ala	Thr	Gly	His	Val			
				420					425					430				
ccc	acc	ttt	gat	gag	tac	ttg	aat	aat	ggc	aca	cca	aac	act	ggg	atg			1344
Pro	Thr	Phe	Asp	Glu	Tyr	Leu	Asn	Asn	Gly	Thr	Pro	Asn	Thr	Gly	Met			
			435					440					445					
tgt	gta	ttg	aat	ttg	att	ccg	ctt	ctg	tta	atg	ggg	gaa	cat	tta	cca			1392
Cys	Val	Leu	Asn	Leu	Ile	Pro	Leu	Leu	Leu	Met	Gly	Glu	His	Leu	Pro			
		450					455					460						
atc	gac	att	ctg	gag	caa	ata	ttc	ttg	ccc	tcc	agg	ttc	cac	cat	ctc			1440
Ile	Asp	Ile	Leu	Glu	Gln	Ile	Phe	Leu	Pro	Ser	Arg	Phe	His	His	Leu			
	465					470					475							
att	gaa	ttg	gct	tcc	agg	ctc	gtc	gat	gac	gcg	aga	gat	ttc	cag	gcg			1488
Ile	Glu	Leu	Ala	Ser	Arg	Leu	Val	Asp	Asp	Ala	Arg	Asp	Phe	Gln	Ala			
	480				485					490					495			
gag	aag	gat	cat	ggg	gat	tta	tcg	tgt	att	gag	tgt	tat	tta	aaa	gat			1536
Glu	Lys	Asp	His	Gly	Asp	Leu	Ser	Cys	Ile	Glu	Cys	Tyr	Leu	Lys	Asp			
				500				505						510				
cat	cct	gag	tct	aca	gta	gaa	gat	gct	tta	aat	cat	gtt	aat	ggc	ctc			1584
His	Pro	Glu	Ser	Thr	Val	Glu	Asp	Ala	Leu	Asn	His	Val	Asn	Gly	Leu			
			515					520					525					
ctt	ggc	aat	tgc	ctt	ctg	gaa	atg	aat	tgg	aag	ttc	tta	aag	aag	cag			1632
Leu	Gly	Asn	Cys	Leu	Leu	Glu	Met	Asn	Trp	Lys	Phe	Leu	Lys	Lys	Gln			
		530					535					540						
gac	agt	gtg	cca	ctc	tcg	tgt	aag	aag	tac	agc	ttc	cat	gta	ttg	gca			1680
Asp	Ser	Val	Pro	Leu	Ser	Cys	Lys	Lys	Tyr	Ser	Phe	His	Val	Leu	Ala			
	545					550					555							
cga	agc	atc	caa	ttc	atg	tac	aat	caa	ggc	gat	ggc	ttc	tcc	att	tcg			1728
Arg	Ser	Ile	Gln	Phe	Met	Tyr	Asn	Gln	Gly	Asp	Gly	Phe	Ser	Ile	Ser			
	560				565					570					575			

aac	aaa	gtg	atc	aag	gat	caa	gtg	cag	aaa	ggt	ctt	att	gtc	ccc	gtg	1776
Asn	Lys	Val	Ile	Lys	Asp	Gln	Val	Gln	Lys	Val	Leu	Ile	Val	Pro	Val	
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cct	att	tga														1785
Pro	Ile	*														

<210> 50
 <211> 593
 <212> PRT
 <213> *Abies grandis*

<400> 50															
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			20					25					30		
Asp	Arg	Ile	Gln	Ser	Leu	Asn	Ser	Pro	Tyr	Gly	Ala	Pro	Ala	Tyr	Gln
		35					40					45			
Glu	Arg	Ser	Glu	Lys	Leu	Ile	Glu	Glu	Ile	Lys	Leu	Phe	Leu	Ser	
	50					55					60				
Asp	Met	Asp	Asp	Ser	Cys	Asn	Asp	Ser	Asp	Arg	Asp	Leu	Ile	Lys	Arg
65					70					75					80
Leu	Glu	Ile	Val	Asp	Thr	Val	Glu	Cys	Leu	Gly	Ile	Asp	Arg	His	Phe
			85						90					95	
Gln	Pro	Glu	Ile	Lys	Leu	Ala	Leu	Asp	Tyr	Val	Tyr	Arg	Cys	Trp	Asn
			100					105					110		
Glu	Arg	Gly	Ile	Gly	Glu	Gly	Ser	Arg	Asp	Ser	Leu	Lys	Lys	Asp	Leu
		115					120					125			
Asn	Ala	Thr	Ala	Leu	Gly	Phe	Arg	Ala	Leu	Arg	Leu	His	Arg	Tyr	Asn
	130					135					140				
Val	Ser	Ser	Gly	Val	Leu	Glu	Asn	Phe	Arg	Asp	Asp	Asn	Gly	Gln	Phe
145					150					155					160
Phe	Cys	Gly	Ser	Thr	Val	Glu	Glu	Glu	Gly	Ala	Glu	Ala	Tyr	Asn	Lys
			165						170					175	
His	Val	Arg	Cys	Met	Leu	Ser	Leu	Ser	Arg	Ala	Ser	Asn	Ile	Leu	Phe
			180					185					190		
Pro	Gly	Glu	Lys	Val	Met	Glu	Glu	Ala	Lys	Ala	Phe	Thr	Thr	Asn	Tyr
		195					200					205			
Leu	Lys	Lys	Val	Leu	Ala	Gly	Arg	Glu	Ala	Thr	His	Val	Asp	Glu	Ser
		210				215					220				
Leu	Leu	Gly	Glu	Val	Lys	Tyr	Ala	Leu	Glu	Phe	Pro	Trp	His	Cys	Ser
225					230					235					240
Val	Gln	Arg	Trp	Glu	Ala	Arg	Ser	Phe	Ile	Glu	Ile	Phe	Gly	Gln	Ile
			245						250					255	
Asp	Ser	Glu	Leu	Lys	Ser	Asn	Leu	Ser	Lys	Lys	Met	Leu	Glu	Leu	Ala
			260					265					270		
Lys	Leu	Asp	Phe	Asn	Ile	Leu	Gln	Cys	Thr	His	Gln	Lys	Glu	Leu	Gln
		275					280					285			
Ile	Ile	Ser	Arg	Trp	Phe	Ala	Asp	Ser	Ser	Ile	Ala	Ser	Leu	Asn	Phe

290		295		300															
Tyr	Arg	Lys	Cys	Tyr	Val	Glu	Phe	Tyr	Phe	Trp	Met	Ala	Ala	Ala	Ile				
305					310					315					320				
Ser	Glu	Pro	Glu	Phe	Ser	Gly	Ser	Arg	Val	Ala	Phe	Thr	Lys	Ile	Ala				
				325					330						335				
Ile	Leu	Met	Thr	Met	Leu	Asp	Asp	Leu	Tyr	Asp	Thr	His	Gly	Thr	Leu				
			340					345					350						
Asp	Gln	Leu	Lys	Ile	Phe	Thr	Glu	Gly	Val	Arg	Arg	Trp	Asp	Val	Ser				
		355					360					365							
Leu	Val	Glu	Gly	Leu	Pro	Asp	Phe	Met	Lys	Ile	Ala	Phe	Glu	Phe	Trp				
	370				375						380								
Leu	Lys	Thr	Ser	Asn	Glu	Leu	Ile	Ala	Glu	Ala	Val	Lys	Ala	Gln	Gly				
385					390					395					400				
Gln	Asp	Met	Ala	Ala	Tyr	Ile	Arg	Lys	Asn	Ala	Trp	Glu	Arg	Tyr	Leu				
			405						410					415					
Glu	Ala	Tyr	Leu	Gln	Asp	Ala	Glu	Trp	Ile	Ala	Thr	Gly	His	Val	Pro				
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Thr	Phe	Asp	Glu	Tyr	Leu	Asn	Asn	Gly	Thr	Pro	Asn	Thr	Gly	Met	Cys				
		435				440						445							
Val	Leu	Asn	Leu	Ile	Pro	Leu	Leu	Leu	Met	Gly	Glu	His	Leu	Pro	Ile				
	450					455				460									
Asp	Ile	Leu	Glu	Gln	Ile	Phe	Leu	Pro	Ser	Arg	Phe	His	His	Leu	Ile				
465					470					475					480				
Glu	Leu	Ala	Ser	Arg	Leu	Val	Asp	Asp	Ala	Arg	Asp	Phe	Gln	Ala	Glu				
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Lys	Asp	His	Gly	Asp	Leu	Ser	Cys	Ile	Glu	Cys	Tyr	Leu	Lys	Asp	His				
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Pro	Glu	Ser	Thr	Val	Glu	Asp	Ala	Leu	Asn	His	Val	Asn	Gly	Leu	Leu				
		515					520					525							
Gly	Asn	Cys	Leu	Leu	Glu	Met	Asn	Trp	Lys	Phe	Leu	Lys	Lys	Gln	Asp				
	530				535					540									
Ser	Val	Pro	Leu	Ser	Cys	Lys	Lys	Tyr	Ser	Phe	His	Val	Leu	Ala	Arg				
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Ser	Ile	Gln	Phe	Met	Tyr	Asn	Gln	Gly	Asp	Gly	Phe	Ser	Ile	Ser	Asn				
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<210> 51
 <211> 2024
 <212> DNA
 <213> Lycopersicon esculentum

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 <221> CDS
 <222> (32)...(1678)
 <223> VFNT germacrene C synthase

<400> 51

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 Met Ala Ala Ser Ser Ala Asp

52

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Lys	Cys	Arg	Pro	Leu	Ala	Asn	Phe	His	Pro	Ser	Val	Trp	Gly	Tyr	His	
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ttc	ctt	tct	tat	act	cat	gaa	att	act	aat	caa	gaa	aaa	gtt	gaa	gtt	148
Phe	Leu	Ser	Tyr	Thr	His	Glu	Ile	Thr	Asn	Gln	Glu	Lys	Val	Glu	Val	
	25					30					35					
gat	gag	tac	aaa	gag	aca	att	aga	aaa	atg	ctg	gtg	gaa	act	tgc	gac	196
Asp	Glu	Tyr	Lys	Glu	Thr	Ile	Arg	Lys	Met	Leu	Val	Glu	Thr	Cys	Asp	
40					45					50					55	
aat	agc	act	caa	aag	ctt	gtg	ttg	ata	gac	gcg	atg	caa	cga	ttg	gga	244
Asn	Ser	Thr	Gln	Lys	Leu	Val	Leu	Ile	Asp	Ala	Met	Gln	Arg	Leu	Gly	
				60					65					70		
gtg	gct	tat	cat	ttc	gat	aat	gaa	att	gaa	aca	tcc	att	caa	aac	att	292
Val	Ala	Tyr	His	Phe	Asp	Asn	Glu	Ile	Glu	Thr	Ser	Ile	Gln	Asn	Ile	
			75					80					85			
ttt	gat	gca	tcg	tcc	aaa	cag	aat	gat	aat	gac	aac	aac	ctt	tac	gtt	340
Phe	Asp	Ala	Ser	Ser	Lys	Gln	Asn	Asp	Asn	Asp	Asn	Asn	Leu	Tyr	Val	
		90					95					100				
gtg	tct	ctt	cgt	ttt	cga	ctt	gtg	agg	caa	caa	ggc	cat	tac	atg	tct	388
Val	Ser	Leu	Arg	Phe	Arg	Leu	Val	Arg	Gln	Gln	Gly	His	Tyr	Met	Ser	
	105					110					115					
tca	gat	gtg	ttc	aag	caa	ttc	acc	aac	caa	gat	ggg	aaa	ttc	aag	gaa	436
Ser	Asp	Val	Phe	Lys	Gln	Phe	Thr	Asn	Gln	Asp	Gly	Lys	Phe	Lys	Glu	
120					125					130					135	
aca	ctt	act	aat	gat	gtc	caa	gga	tta	ttg	agt	ttg	tat	gaa	gca	tca	484
Thr	Leu	Thr	Asn	Asp	Val	Gln	Gly	Leu	Leu	Ser	Leu	Tyr	Glu	Ala	Ser	
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cat	ctg	aga	gtg	cgt	aat	gag	gag	att	ctt	gaa	gaa	gct	ctt	aca	ttt	532
His	Leu	Arg	Val	Arg	Asn	Glu	Glu	Ile	Leu	Glu	Glu	Ala	Leu	Thr	Phe	
			155					160					165			
acc	acc	act	cat	ctc	gag	tct	att	gtc	tcc	aac	ttg	agc	aat	aat	aat	580
Thr	Thr	Thr	His	Leu	Glu	Ser	Ile	Val	Ser	Asn	Leu	Ser	Asn	Asn	Asn	
		170					175					180				
aac	tct	ctt	aag	gtt	gaa	gtt	ggt	gaa	gcc	tta	act	cag	cct	att	cgc	628
Asn	Ser	Leu	Lys	Val	Glu	Val	Gly	Glu	Ala	Leu	Thr	Gln	Pro	Ile	Arg	
	185					190					195					
atg	act	tta	cca	agg	atg	gga	gct	aga	aaa	tac	ata	tcc	att	tac	gaa	676
Met	Thr	Leu	Pro	Arg	Met	Gly	Ala	Arg	Lys	Tyr	Ile	Ser	Ile	Tyr	Glu	
200					205					210					215	

aac	aat	gat	gca	cac	cac	cat	ttg	ctt	ttg	aaa	ttt	gct	aaa	ttg	gat	724
Asn	Asn	Asp	Ala	His	His	His	Leu	Leu	Leu	Lys	Phe	Ala	Lys	Leu	Asp	
				220					225					230		
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Phe	Asn	Met	Leu	Gln	Lys	Phe	His	Gln	Arg	Glu	Leu	Ser	Asp	Leu	Thr	
			235					240					245			
agg	tgg	tgg	aaa	gat	ttg	gat	ttt	gca	aat	aaa	tat	cca	tat	gca	aga	820
Arg	Trp	Trp	Lys	Asp	Leu	Asp	Phe	Ala	Asn	Lys	Tyr	Pro	Tyr	Ala	Arg	
		250					255					260				
gac	agg	ttg	gtt	gag	tgt	tac	ttc	tgg	ata	tta	gga	gtg	tat	ttt	gag	868
Asp	Arg	Leu	Val	Glu	Cys	Tyr	Phe	Trp	Ile	Leu	Gly	Val	Tyr	Phe	Glu	
	265					270					275					
cca	aaa	tat	agt	cgt	gcg	aga	aaa	atg	atg	aca	aaa	gta	ctc	aac	ctg	916
Pro	Lys	Tyr	Ser	Arg	Ala	Arg	Lys	Met	Met	Thr	Lys	Val	Leu	Asn	Leu	
280					285					290					295	
acc	tcc	att	att	gac	gac	act	ttt	gat	gct	tat	gca	acc	ttt	gac	gaa	964
Thr	Ser	Ile	Ile	Asp	Asp	Thr	Phe	Asp	Ala	Tyr	Ala	Thr	Phe	Asp	Glu	
				300					305					310		
ctt	gtg	act	ttc	aat	gat	gca	atc	cag	aga	tgg	gat	gct	aat	gca	att	1012
Leu	Val	Thr	Phe	Asn	Asp	Ala	Ile	Gln	Arg	Trp	Asp	Ala	Asn	Ala	Ile	
			315					320					325			
gat	tca	ata	caa	cca	tat	atg	aga	cct	gct	tat	caa	gct	ctt	cta	gac	1060
Asp	Ser	Ile	Gln	Pro	Tyr	Met	Arg	Pro	Ala	Tyr	Gln	Ala	Leu	Leu	Asp	
		330					335					340				
att	tac	agt	gaa	atg	gaa	caa	gtg	ttg	tcc	aaa	gaa	ggg	aaa	ctg	gac	1108
Ile	Tyr	Ser	Glu	Met	Glu	Gln	Val	Leu	Ser	Lys	Glu	Gly	Lys	Leu	Asp	
	345					350					355					
cgt	gta	tac	tat	gca	aaa	aat	gag	atg	aaa	aag	ttg	gtg	aga	gcc	tat	1156
Arg	Val	Tyr	Tyr	Ala	Lys	Asn	Glu	Met	Lys	Lys	Leu	Val	Arg	Ala	Tyr	
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ttt	aag	gaa	acc	caa	tgg	ttg	aat	gat	tgt	gac	cat	att	cca	aaa	tat	1204
Phe	Lys	Glu	Thr	Gln	Trp	Leu	Asn	Asp	Cys	Asp	His	Ile	Pro	Lys	Tyr	
				380					385					390		
gag	gaa	caa	gtg	gag	aat	gca	atc	gta	agt	gct	ggc	tat	atg	atg	ata	1252
Glu	Glu	Gln	Val	Glu	Asn	Ala	Ile	Val	Ser	Ala	Gly	Tyr	Met	Met	Ile	
			395					400					405			
tca	aca	act	tgc	ttg	gtc	ggg	ata	gaa	gaa	ttt	ata	tcc	cac	gag	act	1300
Ser	Thr	Thr	Cys	Leu	Val	Gly	Ile	Glu	Glu	Phe	Ile	Ser	His	Glu	Thr	
		410					415					420				

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Phe Glu Trp Leu Met Asn Glu Ser Val Ile Val Arg Ala Ser Ala Leu	
425 430 435	
att gcc aga gca atg aac gat att gtt gga cat gaa gat gaa caa gaa	1396
Ile Ala Arg Ala Met Asn Asp Ile Val Gly His Glu Asp Glu Gln Glu	
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aga gga cat gta gct tca ctt att gaa tgt tac atg aaa gat tat gga	1444
Arg Gly His Val Ala Ser Leu Ile Glu Cys Tyr Met Lys Asp Tyr Gly	
460 465 470	
gct tca aag caa gag act tac att aag ttc ctg aaa gag gtc acc aat	1492
Ala Ser Lys Gln Glu Thr Tyr Ile Lys Phe Leu Lys Glu Val Thr Asn	
475 480 485	
gca tgg aag gac ata aac aaa caa ttc tcc cgt cca act gaa gta cca	1540
Ala Trp Lys Asp Ile Asn Lys Gln Phe Ser Arg Pro Thr Glu Val Pro	
490 495 500	
atg ttt gtc ctt gaa cga gtt cta aat ttg aca cgt gtg gct gac acg	1588
Met Phe Val Leu Glu Arg Val Leu Asn Leu Thr Arg Val Ala Asp Thr	
505 510 515	
tta tat aag gag aaa gat aca tat tca acc gcc aaa gga aaa ctt aaa	1636
Leu Tyr Lys Glu Lys Asp Thr Tyr Ser Thr Ala Lys Gly Lys Leu Lys	
520 525 530 535	
aac atg att aat cca ata cta att gaa tct gtc aaa ata taa	1678
Asn Met Ile Asn Pro Ile Leu Ile Glu Ser Val Lys Ile *	
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taaattgaag actcacaaca tatgagttgt taattcctgg gatgtttgaa ataaacaata	1798
attgttttta tttaatttgc taagccaaag tgaaatatac aacacttgag ttgtattaaa	1858
tcatgtttta tctcatttcc agcttgtag tttggattat tatattgtta attatcatca	1918
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<210> 52

<211> 548

<212> PRT

<213> Lycopersicon esculentum

<400> 52

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35 40 45	
Met Leu Val Glu Thr Cys Asp Asn Ser Thr Gln Lys Leu Val Leu Ile	
50 55 60	

Asp 65	Ala	Met	Gln	Arg	Leu 70	Gly	Val	Ala	Tyr	His 75	Phe	Asp	Asn	Glu	Ile 80
Glu	Thr	Ser	Ile	Gln 85	Asn	Ile	Phe	Asp 90	Ala	Ser	Ser	Lys	Gln 95	Asn	Asp
Asn	Asp	Asn	Asn 100	Leu	Tyr	Val	Val	Ser 105	Leu	Arg	Phe	Arg	Leu 110	Val	Arg
Gln	Gln	Gly 115	His	Tyr	Met	Ser	Ser 120	Asp	Val	Phe	Lys	Gln 125	Phe	Thr	Asn
Gln 130	Asp	Gly	Lys	Phe	Lys	Glu 135	Thr	Leu	Thr	Asn	Asp 140	Val	Gln	Gly	Leu
Leu 145	Ser	Leu	Tyr	Glu	Ala 150	Ser	His	Leu	Arg	Val	Arg	Asn	Glu	Glu	Ile 160
Leu	Glu	Glu	Ala	Leu 165	Thr	Phe	Thr	Thr	Thr	His	Leu	Glu	Ser	Ile 175	Val
Ser	Asn	Leu	Ser 180	Asn	Asn	Asn	Asn	Ser 185	Leu	Lys	Val	Glu	Val 190	Gly	Glu
Ala	Leu	Thr 195	Gln	Pro	Ile	Arg	Met 200	Thr	Leu	Pro	Arg	Met 205	Gly	Ala	Arg
Lys	Tyr 210	Ile	Ser	Ile	Tyr	Glu 215	Asn	Asn	Asp	Ala	His	His 220	His	Leu	Leu
Leu 225	Lys	Phe	Ala	Lys	Leu 230	Asp	Phe	Asn	Met	Leu 235	Gln	Lys	Phe	His	Gln 240
Arg	Glu	Leu	Ser	Asp 245	Leu	Thr	Arg	Trp	Trp 250	Lys	Asp	Leu	Asp	Phe 255	Ala
Asn	Lys	Tyr	Pro 260	Tyr	Ala	Arg	Asp	Arg 265	Leu	Val	Glu	Cys	Tyr 270	Phe	Trp
Ile	Leu	Gly 275	Val	Tyr	Phe	Glu	Pro 280	Lys	Tyr	Ser	Arg	Ala 285	Arg	Lys	Met
Met	Thr 290	Lys	Val	Leu	Asn	Leu 295	Thr	Ser	Ile	Ile	Asp	Asp 300	Thr	Phe	Asp
Ala	Tyr	Ala	Thr	Phe	Asp 310	Glu	Leu	Val	Thr	Phe	Asn	Asp	Ala	Ile	Gln 320
Arg	Trp	Asp	Ala	Asn 325	Ala	Ile	Asp	Ser	Ile	Gln	Pro	Tyr	Met	Arg 335	Pro
Ala	Tyr	Gln	Ala 340	Leu	Leu	Asp	Ile	Tyr	Ser	Glu	Met	Glu	Gln 350	Val	Leu
Ser	Lys	Glu	Gly 355	Lys	Leu	Asp	Arg 360	Val	Tyr	Tyr	Ala	Lys	Asn 365	Glu	Met
Lys	Lys 370	Leu	Val	Arg	Ala	Tyr 375	Phe	Lys	Glu	Thr	Gln	Trp	Leu	Asn	Asp
Cys	Asp	His	Ile	Pro	Lys 390	Tyr	Glu	Glu	Gln	Val	Glu	Asn	Ala	Ile	Val 400
Ser	Ala	Gly	Tyr	Met 405	Met	Ile	Ser	Thr	Thr	Cys	Leu	Val	Gly	Ile 415	Glu
Glu	Phe	Ile	Ser 420	His	Glu	Thr	Phe	Glu	Trp	Leu	Met	Asn	Glu	Ser	Val
Ile	Val	Arg	Ala 435	Ser	Ala	Leu	Ile	Ala	Arg	Ala	Met	Asn	Asp	Ile	Val
Gly	His	Glu	Asp	Glu	Gln	Glu 455	Arg	Gly	His	Val	Ala	Ser	Leu	Ile	Glu
Cys	Tyr	Met	Lys	Asp	Tyr 470	Gly	Ala	Ser	Lys	Gln	Glu	Thr	Tyr	Ile	Lys 480
Phe	Leu	Lys	Glu	Val	Thr	Asn	Ala	Trp	Lys	Asp	Ile	Asn	Lys	Gln	Phe

Ser	Arg	Pro	Thr	485	Glu	Val	Pro	Met	Phe	490	Val	Leu	Glu	Arg	Val	Leu	Asn	495
			500						505						510			
Leu	Thr	Arg	Val	Ala	Asp	Thr	Leu	Tyr	Lys	Glu	Lys	Asp	Thr	Tyr	Ser			
		515					520					525						
Thr	Ala	Lys	Gly	Lys	Leu	Lys	Asn	Met	Ile	Asn	Pro	Ile	Leu	Ile	Glu			
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Ser	Val	Lys	Ile															
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<210> 53
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 <212> DNA
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 <220>
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Met	Pro	Leu	Asn	Ser	Leu	His	Asn	Phe	Glu	Arg	Lys	Pro	Ser	Lys	Ala		
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tgg	tct	acc	tct	tgc	act	gca	ccc	gca	gct	cgc	ctc	cgg	gca	tct	tcc		148
Trp	Ser	Thr	Ser	Cys	Thr	Ala	Pro	Ala	Ala	Arg	Leu	Arg	Ala	Ser	Ser		
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tcc	tta	caa	caa	gaa	aaa	cct	cac	caa	atc	cga	cgc	tct	ggg	gat	tac		196
Ser	Leu	Gln	Gln	Glu	Lys	Pro	His	Gln	Ile	Arg	Arg	Ser	Gly	Asp	Tyr		
			45					50					55				
caa	ccc	tct	ctt	tgg	gat	ttc	aat	tac	ata	cag	tct	ctc	aac	act	ccg		244
Gln	Pro	Ser	Leu	Trp	Asp	Phe	Asn	Tyr	Ile	Gln	Ser	Leu	Asn	Thr	Pro		
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tat	aag	gag	cag	aga	cac	ttt	aat	agg	caa	gca	gag	ttg	att	atg	caa		292
Tyr	Lys	Glu	Gln	Arg	His	Phe	Asn	Arg	Gln	Ala	Glu	Leu	Ile	Met	Gln		
	75					80					85						
gtg	agg	atg	ttg	ctc	aag	gta	aag	atg	gag	gca	att	caa	cag	ttg	gag		340
Val	Arg	Met	Leu	Leu	Lys	Val	Lys	Met	Glu	Ala	Ile	Gln	Gln	Leu	Glu		
	90				95					100					105		
ttg	att	gat	gac	ttg	caa	tac	ctg	gga	ctg	tct	tat	ttc	ttt	caa	gat		388
Leu	Ile	Asp	Asp	Leu	Gln	Tyr	Leu	Gly	Leu	Ser	Tyr	Phe	Phe	Gln	Asp		
				110					115					120			

gag Glu	att Ile	aaa Lys	caa Gln 125	atc Ile	tta Leu	agt Ser	tct Ser	ata Ile 130	cac His	aat Asn	gag Glu	ccc Pro	aga Arg 135	tat Tyr	ttc Phe	436
cac His	aat Asn 140	aat Asn	gat Asp	ttg Leu	tat Tyr	ttc Phe	aca Thr 145	gct Ala	ctt Leu	gga Gly	ttc Phe	aga Arg 150	atc Ile	ctc Leu	aga Arg	484
caa Gln 155	cat His	ggt Gly	ttt Phe	aat Asn	gtt Val	tcc Ser 160	gaa Glu	gat Asp	gta Val	ttt Phe	gat Asp 165	tgt Cys	ttc Phe	aaa Lys	att Ile	532
gag Glu 170	aag Lys	tgc Cys	agt Ser	gat Asp	ttc Phe 175	aat Asn	gca Ala	aac Asn	ctt Leu	gct Ala 180	caa Gln	gat Asp	acg Thr	aag Lys	gga Gly 185	580
atg Met	tta Leu	caa Gln	ctt Leu	tat Tyr 190	gaa Glu	gca Ala	tct Ser	ttc Phe	ctt Leu 195	ttg Leu	aga Arg	gaa Glu	ggt Gly	gaa Glu 200	gat Asp	628
aca Thr	ttg Leu	gag Glu	cta Leu 205	gca Ala	aga Arg	cga Arg	ttt Phe	tcc Ser 210	acc Thr	aga Arg	tct Ser	cta Leu	cga Arg 215	gaa Glu	aaa Lys	676
ttt Phe	gat Asp	gaa Glu 220	ggt Gly	ggt Gly	gat Asp	gaa Glu	att Ile 225	gat Asp	gaa Glu	gat Asp	cta Leu	tca Ser 230	tcg Ser	tgg Trp	att Ile	724
cgc Arg	cat His 235	tcc Ser	ttg Leu	gat Asp	ctt Leu	cct Pro 240	ctt Leu	cat His	tgg Trp	agg Arg	gtc Val 245	caa Gln	gga Gly	tta Leu	gag Glu	772
gca Ala 250	aga Arg	tgg Trp	ttc Phe	tta Leu	gat Asp 255	gct Ala	tat Tyr	gcg Ala	agg Arg	agg Arg 260	ccg Pro	gac Asp	atg Met	aat Asn	cca Pro 265	820
ctt Leu	att Ile	ttc Phe	aaa Lys	ctc Leu 270	gcc Ala	aaa Lys	ctc Leu	aac Asn	ttc Phe 275	aat Asn	att Ile	gtt Val	cag Gln	gca Ala 280	aca Thr	868
tat Tyr	caa Gln	gaa Glu	gaa Glu 285	ctg Leu	aaa Lys	gat Asp	atc Ile	tca Ser 290	agg Arg	tgg Trp	tgg Trp	aat Asn	agt Ser 295	tcg Ser	tgc Cys	916
ctt Leu	gct Ala	gag Glu 300	aaa Lys	ctc Leu	cca Pro	ttt Phe	gtg Val 305	aga Arg	gat Asp	agg Arg	att Ile	gtg Val 310	gaa Glu	tgc Cys	ttc Phe	964
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aaa	atg	gcc	gcc	gtt	att	att	act	ttc	ata	aca	att	atc	gat	gat	gtt	1060

Lys 330	Met	Ala	Ala	Val	Ile 335	Ile	Thr	Phe	Ile	Thr 340	Ile	Ile	Asp	Asp	Val 345	
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caa Gln	gtg Val	tgc Cys 380	tat Tyr	ttg Leu	gca Ala	cta Leu	tac Tyr 385	aac Asn	ttc Phe	gtt Val	tct Ser	gag Glu 390	cgg Arg	gct Ala	tac Tyr	1204
gat Asp	att Ile 395	cta Leu	aaa Lys	gat Asp	caa Gln	cat His 400	ttc Phe	aac Asn	agc Ser	atc Ile	cca Pro 405	tat Tyr	tta Leu	cag Gln	aga Arg	1252
tcg Ser 410	tgg Trp	gta Val	agt Ser	ttg Leu 415	gtt Val	gaa Glu	gga Gly	tat Tyr	ctt Leu 420	aag Lys	gag Glu	gca Ala	tac Tyr	tgg Trp 425	tac Tyr	1300
tac Tyr	aat Asn	ggc Gly	tat Tyr	aaa Lys 430	cca Pro	agc Ser	ttg Leu	gaa Glu	gaa Glu 435	tat Tyr	ctc Leu	aac Asn	aac Asn	gcc Ala 440	aag Lys	1348
att Ile	tca Ser	ata Ile	tcg Ser 445	gct Ala	cct Pro	aca Thr	atc Ile	ata Ile 450	tcc Ser	cag Gln	ctt Leu	tat Tyr	ttt Phe 455	aca Thr	tta Leu	1396
gca Ala	aac Asn	tcg Ser 460	att Ile	gat Asp	gaa Glu	aca Thr	gct Ala 465	atc Ile	gag Glu	agc Ser	ttg Leu	tac Tyr 470	caa Gln	tat Tyr	cat His	1444
aac Asn 475	ata Ile	ctt Leu	tac Tyr	cta Leu	tca Ser	gga Gly 480	acc Thr	ata Ile	tta Leu	agg Arg	ctt Leu 485	gct Ala	gac Asp	gat Asp	ctt Leu	1492
ggg Gly 490	aca Thr	tca Ser	caa Gln	cat His	gag Glu 495	ctg Leu	gag Glu	aga Arg	gga Gly	gac Asp 500	gta Val	ccg Pro	aaa Lys	gca Ala	atc Ile 505	1540
cag Gln	tgc Cys	tac Tyr	atg Met	aat Asn 510	gac Asp	aca Thr	aat Asn	gct Ala	tcg Ser 515	gag Glu	aga Arg	gag Glu	gcg Ala	gtg Val 520	gaa Glu	1588
cac His	gtg Val	aag Lys	ttt Phe 525	ctg Leu	ata Ile	agg Arg	gag Glu	gcg Ala 530	tgg Trp	aag Lys	gag Glu	atg Met	aac Asn 535	acg Thr	gtc Val	1636
aca Thr	aca Thr	gcc Ala	agc Ser	gat Asp	tgt Cys	ccg Pro	ttt Phe	acg Thr	gat Asp	gat Asp	ttg Leu	gtt Val	gcg Ala	gcc Ala	gca Ala	1684

540	545	550	
gct aat ctt gca agg gcg gct cag ttt ata tat ctc gac ggg gat ggg			1732
Ala Asn Leu Ala Arg Ala Ala Gln Phe Ile Tyr Leu Asp Gly Asp Gly			
555	560	565	
cat ggc gtg caa cac tca gaa ata cat caa cag atg gga ggc ctg cta			1780
His Gly Val Gln His Ser Glu Ile His Gln Gln Met Gly Gly Leu Leu			
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ttc cag cct tat gtc tga ataaatcgaa aatccaacct actatgtatc			1828
Phe Gln Pro Tyr Val *			
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 <211> 590
 <212> PRT
 <213> *Salvia officinalis*

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His Gln Ile Arg Arg Ser Gly Asp Tyr Gln Pro Ser Leu Trp Asp Phe	
50 55 60	
Asn Tyr Ile Gln Ser Leu Asn Thr Pro Tyr Lys Glu Gln Arg His Phe	
65 70 75 80	
Asn Arg Gln Ala Glu Leu Ile Met Gln Val Arg Met Leu Leu Lys Val	
85 90 95	
Lys Met Glu Ala Ile Gln Gln Leu Glu Leu Ile Asp Asp Leu Gln Tyr	
100 105 110	
Leu Gly Leu Ser Tyr Phe Phe Gln Asp Glu Ile Lys Gln Ile Leu Ser	
115 120 125	
Ser Ile His Asn Glu Pro Arg Tyr Phe His Asn Asn Asp Leu Tyr Phe	
130 135 140	
Thr Ala Leu Gly Phe Arg Ile Leu Arg Gln His Gly Phe Asn Val Ser	
145 150 155 160	
Glu Asp Val Phe Asp Cys Phe Lys Ile Glu Lys Cys Ser Asp Phe Asn	
165 170 175	
Ala Asn Leu Ala Gln Asp Thr Lys Gly Met Leu Gln Leu Tyr Glu Ala	
180 185 190	
Ser Phe Leu Leu Arg Glu Gly Glu Asp Thr Leu Glu Leu Ala Arg Arg	
195 200 205	
Phe Ser Thr Arg Ser Leu Arg Glu Lys Phe Asp Glu Gly Gly Asp Glu	
210 215 220	
Ile Asp Glu Asp Leu Ser Ser Trp Ile Arg His Ser Leu Asp Leu Pro	
225 230 235 240	

Leu	His	Trp	Arg	Val	Gln	Gly	Leu	Glu	Ala	Arg	Trp	Phe	Leu	Asp	Ala	
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Tyr	Ala	Arg	Arg	Pro	Asp	Met	Asn	Pro	Leu	Ile	Phe	Lys	Leu	Ala	Lys	
				260				265					270			
Leu	Asn	Phe	Asn	Ile	Val	Gln	Ala	Thr	Tyr	Gln	Glu	Glu	Leu	Lys	Asp	
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Ile	Ser	Arg	Trp	Trp	Asn	Ser	Ser	Cys	Leu	Ala	Glu	Lys	Leu	Pro	Phe	
	290				295						300					
Val	Arg	Asp	Arg	Ile	Val	Glu	Cys	Phe	Phe	Trp	Ala	Ile	Ala	Ala	Phe	
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Glu	Pro	His	Gln	Tyr	Ser	Tyr	Gln	Arg	Lys	Met	Ala	Ala	Val	Ile	Ile	
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Thr	Phe	Ile	Thr	Ile	Ile	Asp	Asp	Val	Tyr	Asp	Val	Tyr	Gly	Thr	Ile	
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Glu	Glu	Leu	Glu	Leu	Leu	Thr	Asp	Met	Ile	Arg	Arg	Trp	Asp	Asn	Lys	
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Ser	Ile	Ser	Gln	Leu	Pro	Tyr	Tyr	Met	Gln	Val	Cys	Tyr	Leu	Ala	Leu	
	370					375					380					
Tyr	Asn	Phe	Val	Ser	Glu	Arg	Ala	Tyr	Asp	Ile	Leu	Lys	Asp	Gln	His	
385					390					395					400	
Phe	Asn	Ser	Ile	Pro	Tyr	Leu	Gln	Arg	Ser	Trp	Val	Ser	Leu	Val	Glu	
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Gly	Tyr	Leu	Lys	Glu	Ala	Tyr	Trp	Tyr	Tyr	Asn	Gly	Tyr	Lys	Pro	Ser	
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Leu	Glu	Glu	Tyr	Leu	Asn	Asn	Ala	Lys	Ile	Ser	Ile	Ser	Ala	Pro	Thr	
		435					440					445				
Ile	Ile	Ser	Gln	Leu	Tyr	Phe	Thr	Leu	Ala	Asn	Ser	Ile	Asp	Glu	Thr	
	450					455					460					
Ala	Ile	Glu	Ser	Leu	Tyr	Gln	Tyr	His	Asn	Ile	Leu	Tyr	Leu	Ser	Gly	
465					470					475					480	
Thr	Ile	Leu	Arg	Leu	Ala	Asp	Asp	Leu	Gly	Thr	Ser	Gln	His	Glu	Leu	
				485					490					495		
Glu	Arg	Gly	Asp	Val	Pro	Lys	Ala	Ile	Gln	Cys	Tyr	Met	Asn	Asp	Thr	
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Glu	Ala	Trp	Lys	Glu	Met	Asn	Thr	Val	Thr	Thr	Ala	Ser	Asp	Cys	Pro	
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Phe	Thr	Asp	Asp	Leu	Val	Ala	Ala	Ala	Ala	Asn	Leu	Ala	Arg	Ala	Ala	
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Arg	Trp	Gly	Lys	Gly	Ser	Asn	Lys	Ile	Ile	Ala	Cys	Val	Gly	Glu	Gly		
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Gly	Ala	Thr	Ser	Val	Pro	Tyr	Gln	Ser	Ala	Glu	Lys	Asn	Asp	Ser	Leu		
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tct	tct	tct	aca	ttg	gtg	aaa	cga	gaa	ttt	cct	cca	gga	ttt	tgg	aag		287
Ser	Ser	Ser	Thr	Leu	Val	Lys	Arg	Glu	Phe	Pro	Pro	Gly	Phe	Trp	Lys		
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Trp	Val	Ala	Arg	Ile	Pro	Ala	Val	Asp	Gly	Ser	Asp	Asn	Pro	His	Phe		
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Asp	Glu	Ala	Asp	Ser	His	Arg	Pro	Ser	Gly	Phe	Glu	Ile	Val	Phe	Pro	
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Ala	Met	Leu	Lys	Glu	Ala	Lys	Ile	Leu	Gly	Leu	Asp	Leu	Pro	Tyr	Asp	
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Arg	Ile	Pro	Thr	Asp	Val	Leu	Tyr	Ala	Leu	Pro	Thr	Thr	Leu	Leu	Tyr	
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Leu	Gln	Ser	Lys	Asp	Gly	Ser	Phe	Leu	Ser	Ser	Pro	Ala	Ser	Thr	Ala	
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Ile	Asp	Arg	His	Phe	Lys	Glu	Glu	Ile	Lys	Glu	Ala	Leu	Asp	Tyr	Val	
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His	Gly	Tyr	Asn	Val	Ser	Ser	Asp	Val	Leu	Lys	Thr	Phe	Arg	Asp	Glu	
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Ala	Leu	Glu	Asn	Val	Asp	Ala	Phe	Asp	Lys	Trp	Ala	Phe	Lys	Lys	Asn	
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Met	Pro	Arg	Leu	Glu	Ala	Arg	Ser	Tyr	Ile	Glu	Asn	Tyr	Gly	Pro	Asp	
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Phe	Ser	Pro	Ala	Ser	Phe	Ile	Phe	Glu	Pro	Glu	Phe	Ser	Lys	Cys	Arg	
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Glu	Val	Tyr	Thr	Lys	Thr	Ser	Asn	Phe	Thr	Val	Ile	Leu	Asp	Asp	Leu	
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Val	Lys	Arg	Trp	Asp	Leu	Ser	Leu	Val	Asp	Gln	Met	Pro	Gln	Gln	Met	
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Gln	Cys	Tyr	Met	Lys	Asp	His	Pro	Lys	Ile	Ser	Glu	Glu	Glu	Ala	Leu	
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Gln	His	Val	Tyr	Ser	Val	Met	Glu	Asn	Ala	Leu	Glu	Glu	Leu	Asn	Arg	
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Thr	Leu	Ser	His	Asp	Met	Glu	Ile	Lys	Glu	His	Val	Lys	Asn	Cys	Leu		
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Phe	Gln	Pro	Val	Ala	*												
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Pro	Phe	Leu	Lys	245 Gln	Ile	Ile	Glu	Lys	250 Arg	Glu	Ala	Lys	255 Leu	Lys	Arg
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Ile	Met	Glu	455 Glu	Ala	Lys	Leu	Cys	460 Thr	Glu	Arg	Tyr	Leu	Arg	Asn	Ala
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Asp	Ala	His	610 Gly	Ser	Leu	Asp	Asp	615 Leu	Lys	Leu	Phe	Thr	Glu	Ser	Val
625 Lys	Arg	Trp	Asp	Leu	Ser	Leu	Val	630 Asp	Gln	Met	Pro	Gln	Gln	Met	Lys
Ile	Cys	Phe	645 Val	Gly	Phe	Tyr	Asn	650 Thr	Phe	Asn	Asp	Ile	Ala	Lys	Glu
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Phe	Leu	Gln	Leu	Met	Gly	Leu	Thr	Gly	Arg	Leu	Val	Asn	Asp	Thr	Lys
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His	Val	Tyr	Ser	Val	Met	Glu	Asn	Ala	Leu	Glu	Glu	Leu	Asn	Arg	Glu
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Pro	Gly	Glu	Lys	Val	Met	Glu	Glu	Ala	Glu	Ile	Phe	Ser	Ala	Ser	Tyr	
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gaa Glu	gca Ala	aga Arg	aat Asn 290	tat Tyr 290	atc Ile	gag Glu	gtc Val	tac Tyr	gag Glu 295	cag Gln	agc Ser	ggc Gly	tat Tyr	gaa Glu 300	agc Ser	975
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aaa Lys	ttg Leu	gag Glu 320	ttc Phe	aat Asn	atc Ile	ttt Phe	cac His 325	tct Ser	ttg Leu	caa Gln	cta Leu	aga Arg 330	gag Glu	tta Leu	caa Gln	1071
tct Ser 335	atc Ile	tcc Ser	aga Arg	tgg Trp	tgg Trp	aaa Lys 340	gaa Glu	tca Ser	ggt Gly	tcc Ser	tct Ser 345	caa Gln	ctg Leu	act Thr	ttt Phe	1119
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atg Met	ttg Leu	cca Pro	aaa Lys 370	cat His	tca Ser	gct Ala	ttc Phe	aga Arg	atg Met 375	gag Glu	ttt Phe	gtc Val	aaa Lys	gtg Val 380	tgt Cys	1215
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cga Arg	gat Asp	atg Met	ctc Leu	aac Asn 450	tat Tyr	att Ile	caa Gln	aat Asn 455	gct Ala 455	tgg Trp	gaa Glu	gcc Ala	cta Leu	ttt Phe 460	gat Asp	1455
acc Thr	ttt Phe	atg Met	caa Gln 465	gaa Glu	gca Ala	aag Lys	tgg Trp	atc Ile 470	tcc Ser	agc Ser	agt Ser	tat Tyr	ctc Leu 475	cca Pro	acg Thr	1503

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Phe Glu Glu Tyr Leu Lys Asn Ala Lys Val Ser Ser Gly Ser Arg Ile	
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Ala Thr Leu Gln Pro Ile Leu Thr Leu Asp Val Pro Leu Pro Asp Tyr	
495 500 505	
ata ctg caa gaa att gat tat cca tcc aga ttc aat gag tta gct tcg	1647
Ile Leu Gln Glu Ile Asp Tyr Pro Ser Arg Phe Asn Glu Leu Ala Ser	
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Ser Ile Leu Arg Leu Arg Gly Asp Thr Arg Cys Tyr Lys Ala Asp Arg	
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Ala Arg Gly Glu Glu Ala Ser Ala Ile Ser Cys Tyr Met Lys Asp His	
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Pro Gly Ser Ile Glu Glu Asp Ala Leu Asn His Ile Asn Ala Met Ile	
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Ser Asp Ala Ile Arg Glu Leu Asn Trp Glu Leu Leu Arg Pro Asp Ser	
575 580 585	
aaa agt ccc atc tct tcc aag aaa cat gct ttt gac atc acc aga gct	1887
Lys Ser Pro Ile Ser Ser Lys Lys His Ala Phe Asp Ile Thr Arg Ala	
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Phe His His Val Tyr Lys Tyr Arg Asp Gly Tyr Thr Val Ser Asn Asn	
610 615 620	
gaa aca aag aat ttg gtg atg aaa acc gtt ctt gaa cct ctc gct ttg	1983
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625 630 635	
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